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PRACTICAL EXAMINATIONS,

&c.

Class IX.—*Brachialia.*—Emergencies occurring to the upper extremities.

Order I.—*Claviculo-scapularia.* Claviculo-scapular.

Genus I.—*Dislocatio.* Dislocation.

Species I.—*Dislocatio claviculæ.* Dislocation of the clavicle.

State the displacements that may occur to the articulations of the clavicle.

942. This bone may be dislocated either at the sternal or scapular extremity; but the latter is by far the most common occurrence.

What are the ligaments that confine the sternal end of the clavicle in its natural position?

943. The interclavicular fixes the end of the bone to the opposite clavicle and to the sternum, to which it is also attached by the capsular ligament with its interarticular cartilage. Its inferior sternal edge is also fixed to the cartilage of the first rib by the rhomboid ligament.

In what directions may the bone be displaced from its sternal attachment?

944. Forwards upon the sternum, and backwards behind it.

What are the diagnostic marks of the former?

945. An unnatural projection on the upper part of the sternum, into which the clavicle can be traced, and which disappears when the shoulders are drawn backwards; pain on moving the dislocated bone, and a diminution of the space between the point of the shoulder and sternum; indeed, in thin persons the nature of the accident is ascertained at one glance.

Is this species of dislocation ever partial?

946. Yes; and in this case the anterior portion of the capsular ligament only being torn, the bone projects but slightly.

How is this dislocation to be reduced, and the natural position of the bone maintained?

947. "The clavicle is easily returned to its place by pulling the shoulder backwards, because then it is drawn off the sternum, and its end falls upon the cavity which naturally receives it; but if pressure in this position of the shoulder be not made upon the fore part of the bone, it will be found still liable to project in some degree. The principle, therefore, upon which the extension is made, is to draw the scapula as far from the side as is practicable without inconvenience, and supporting the arm to prevent its weight from influencing the position of the bone. The first of these objects is best effected by the use of the clavicle bandage, and by the application of two pads or cushions affixed to it, which are placed in the axillæ. These pads throw the head of the os humeri from the side, and carry the scapula and the clavicle connected with it outwards and backwards, and thus the clavicle is drawn into its natural articular cavity.

"The second intention is effected by a sling."—*Sir Astley Cooper's Treatise on Dislocation, &c.*

Does the luxation backwards often occur?

948. Sir Astley Cooper says, that he never met with an instance from violence, though he thinks that a blow upon the front of the bone might occasion it, by rupturing the rhomboid ligament and the capsular. He mentions one instance that occurred in the practice of the late Mr. Davie, of Bungay, in Suffolk, and which was occasioned by a distortion of the spine. This disease so advanced the scapula, as to push the sternal extremity of the clavicle from its position, backwards upon the œsophagus, and threaten obstruction to the tube. The end of the bone was on this account successfully removed by Mr. Davie.

What are the principal ligaments that hold the clavicle to the scapula?

949. Strong ligamentous fibres passing from the clavicle to the scapula—the capsular ligament, and the two coraco-clavicular, that fix the bone to the coracoid process of the scapula.

How might a dislocation of the scapular end of the clavicle be detected?

950. "The easiest mode of detecting this accident is to

place the finger upon the spine of the scapula, and to trace this portion of bone forward to the acromion, in which it ends; the finger is stopped by the projection of the clavicle, and so soon as the shoulders are drawn back, the point of the clavicle sinks into its place, but it reappears when the shoulders are let go. The point of the clavicle projects against the skin upon the superior part of the shoulder, and much pain is felt when it is pressed."—*Sir A. Cooper's Treatise, &c.*

What ligaments are ruptured by this accident?

951. When the luxation is complete, the whole of the ligaments just mentioned; but when incomplete, the more internal or conoid ligament may be left entire.

What is the treatment of this case?

952. "The assistant, standing behind the patient, puts his knee between the shoulders and draws them backwards and upwards, when the clavicle sinks into its socket. A thick cushion is then placed in each axilla, for three purposes: 1st, to keep the scapula from the side; 2dly, to raise the scapula; 3dly, to defend the axillæ from being hurt by the bandages, on which last account a cushion is employed on each side. Then the clavicle bandage is applied, and its straps should be sufficiently broad to press upon the clavicle, the scapula, and the upper part of the os humeri, to keep the former down, the scapula inwards and backwards, and the arm backwards and elevated. To secure these objects more effectually, the arm is to be suspended in a short sling, by which it is made to support the scapula in its proper situation."—*Ibid.*

What is the usual result of the treatment of luxations of the clavicle?

953. In most instances some degree of deformity will remain, and such a probability should be mentioned to the patient, to protect the character of the surgeon.

SPECIES 2.—*Dislocatio scapulæ.* Dislocation of the scapula.

What other displacement may take place at this part of the body?

954. "The inferior angle of the scapula occasionally escapes from under the border of the latissimus dorsi, usually with some laceration of the muscular fibres. The displacement is occasioned by raising the arm above the head to an unusual extent. The angle of the bone projects considerably, and the muscle is felt playing beneath it more distinctly during motion

of the parts; the movements of the limb are limited and painful."—*Liston's Elements of Surgery.*

What is the treatment of this kind of injury?

954*. "The parts may be brought into their original position by pressing the angle of the scapula towards the ribs, whilst the arm is much raised; and the bone is afterwards confined in its proper place, by a broad bandage passed tightly round the chest."—*Ibid.*

GENUS 2.—*Fractura.* Fracture.

SPECIES 1.—*Fractura claviculæ.* Fracture of the clavicle.

At what part of the bone, and in what direction, do fractures of the clavicle usually take place?

955. "It generally gives way about the middle. The fracture, when occasioned by force applied to the acromial extremity, is usually oblique; transverse when the force is applied to the shaft of the bone."—*Ibid.*

Does this kind of fracture occasion much deformity at the time of its occurrence?

956. "The displacement is in most cases great; but when the fracture is at the bend near the scapular extremity—a not very uncommon accident, disjunction of the fractured extremities is prevented by the attachments of the conoid and trapezoid ligaments. In ordinary cases, that fractured extremity projects which is attached to the sternum, whilst the scapular portion is depressed and carried forwards. In short, the scapular portion is displaced, the sternal is nearly *in situ*, though, from the depression of the former, the prominence of the latter appears to be the displacement. The arm falls forwards and downwards."—*Ibid.*

Is a fracture of the clavicle readily ascertained?

957. Yes: by the deformity, by the local enlargement, by the shoulder being unnaturally approximated to the chest and depressed, by the motions of the arm being impaired, and by crepitation.

The before-mentioned fracture at the scapular end might not be so readily detected; in this our diagnosis will depend on crepitation, and on the motions of the extremity being impaired.

What is the treatment of a fractured clavicle?

958. Having placed the bones in apposition, "a pad, firm, though of soft material and large enough to fill the arm-pit

completely, is rolled in a shawl, and placed in the axillæ; it is retained by tying the shawl over the opposite shoulder, a soft pad being interposed between the knot and the skin, to prevent excoriation, and is further secured by tying the ends under the axilla of the uninjured extremity, which should also be protected by a small cushion. A few turns of a roller or a handkerchief are placed round the arm and chest, to secure and fix the limb; so the retentive apparatus is completed. The shoulder is thus raised and removed from its unnatural position, and the fractured extremities of the clavicle, previously placed in accurate contact, are prevented from being again displaced. The elbow and fore arm should be supported by a sling."—*Ibid.*

Is any other local or general treatment necessary in this case?

959. None whatever.

How would you treat a compound fracture of the clavicle?

960. Having reduced the protruded bone, and brought the lips of the wound (which is usually small) together by strips of adhesive plaister, the case is to be treated in every other respect as a simple fracture.

What is the treatment of a compound fracture of the clavicle occasioned by gun-shot?

961. "This bone is sometimes implicated in the most tremendous wounds, which from their inflammatory and sloughing disposition, spreading to the thoracic viscera and to the shoulder-joint, have been productive of protracted tortures to the sufferer, rendering life a very dubious blessing indeed. The immediate preservation of existence has, in the fortunate cases, certainly depended on the profuse loss of blood; and the antiphlogistic regimen, with the utmost simplicity of dressing, has perfected the recovery."—*Vide Hennen's Principles of Military Surgery.*

SPECIES 2.—*Fractura scapulæ.* Fracture of the scapula.

Is a simple fracture of the body of the scapula easily detected?

962. This fracture is of rare occurrence in civil practice, and is not readily ascertained, especially after the tumefaction of the parts. As there is little or no displacement, our diagnosis must depend on crepitation, and on pain and difficulty in using the arm.

What treatment should be adopted in this case?

963. "It is sufficient to restrain motion; and this is effected

by passing a bandage round the chest, over the scapula and round the arm."—*Liston's Elements of Surgery.*

At what other points might this bone be fractured?

964. "The acromion process, the spine, or the neck of the bone, may be fractured. A portion of the acromion may be separated along with the ligaments connecting the clavicle to it, in the accident of dislocation of the scapular extremity of that bone. The acromion may also be broken into fragments by heavy falls on the point of the shoulder."—*Vide ibid.*

What would be the diagnosis in this kind of accident?

965. "There is a slight appearance of flattening of the shoulder at first, and then great swelling. Crepitation is felt by pressing gently and alternately with the points of the finger over the fractured part."—*Ibid.*

The diagnostic marks in a case of fracture of the neck of the scapula, which may easily be mistaken for dislocation into the axilla, are three—"1st, the facility with which the parts are replaced; 2dly, the immediate fall of the head of the bone into the axilla, when the extension is removed; and 3dly, the crepitus which is felt at the extremity of the coracoid process of the scapula, when the arm is rotated."—*Sir Astley Cooper's Treatise on Dislocations, &c.*

A simple method, therefore, of discovering this kind of fracture will be, first to raise and support the elbow, which will restore the natural appearance of the shoulder; and secondly, to rotate the arm, when supported, with one hand, whilst the other is placed on the coracoid process, which will immediately discover the crepitus.

State the treatment required in this case.

966. The arm requires to be raised and supported by a sling. At the same time, should the acromion be broken into fragments by great violence, local bleeding, cold evaporating lotions, and the antiphlogistic treatment, will be also required.

What are the usual causes of compound fractures of the scapula, and what is their treatment?

967. Gun-shot; and "such injuries of the scapula itself are not of a very serious nature. Balls make a clear passage through its broad plate, and the splinters occasioned by them are easily removed."—*Hennen's Principles of Military Surgery.*

The only treatment necessary for the injury of the bone, abstractedly, is perfect rest and simple dressings, but the general treatment will depend on the further consequences of the wound that has involved the scapula.—*Vide Thoracic Emergencies,* p. 83.

GENUS 3.—*Vulnus proprium.* Wound occurring in this region.

To what kind of wound is the region of the scapula most subject?

968. To sabre-cuts; and, according to Dr. Hennen, "there are no wounds, if preserved from motion, which appear to unite with greater readiness, and less future inconvenience." —*Principles of Military Surgery.*

Are there any wounds of this part which form an exception to such favourable results?

969. Yes; punctured wounds, opening the supra-scapular arteries, are sometimes the source of fatal hemorrhage. "I have met," says Dr. Hennen, "with one curious case in a French dragoon, who was wounded, in the action of Morales, by a deep sabre-thrust. He was reduced so low by repeated hemorrhage, that when staff-surgeon Dease and myself saw him, all hopes were at an end. The wound had been secured by the twisted suture and by compress, which had partially stopped the hemorrhage. On examination after death, the supra-scapular artery was found to be punctured, and an aneurismal tumour, as large as an egg, was formed at the site of the wound."—*Principles of Military Surgery.*

Can you account for such hemorrhages from the vascularity of the muscles of the scapula?

970. The muscles of the scapulary fossa are plentifully nourished by blood-vessels of considerable size. The supra-spinatus is supplied by the ramus supra-scapularius, which is given off from the transversalis humeri, a branch of the thyroidea inferior, and the infra-spinatus by the arteria dorsalis scapulæ inferior, a branch of the subscapularius: both these arteries, the ramus supra-scapularius and dorsalis scapulæ inferior, freely communicate beneath the acromion, which, together with the vascularity of the parts, will sufficiently account for profuse hemorrhage following deep incised or punctured wounds over the scapula.

Should you fail to check such hemorrhage by compress and bandage, what is the next step you would take?

971. The best treatment would be to lay open the wound freely, and secure the vessels that are pouring out their blood by ligature.

Were you to fail in checking the bleeding by this treatment, and the life of the patient were in imminent danger from loss of blood, what other treatment could you adopt as a dernier resort?

972. If pressure on the axillary artery stop the bleeding,

that vessel ought to be tied without delay (vide 340); if not, it will be right to compress the transversalis humeri, the probable source of the hemorrhage, as it runs transversely near the clavicle towards the notch of the scapula.

Would not a ligature carried around the subclavian be preferable to tying the axillary, with a view of at once restraining both sources of the hemorrhage?

973. Tying the subclavian at the usual point would avail nothing, as the inferior thyroid artery, from which the superior scapulary branch arises, takes its origin nearer the heart, and where it would be impracticable to reach it with safety to the patient.

ORDER II.—*Humeraria.* Emergencies occurring to the upper arm.

GENUS I.—*Dislocatio.* Dislocation.

SPECIES 1.—*Dislocatio humeri simplex.* Simple luxation of the shoulder-joint.

What are the ligaments that connect the head of the humerus to the glenoid cavity of the scapula?

974. The capsular and the cotyloid are the only ligaments that connect this articulation.

But are there not other parts that supply the place of ligaments?

975. Yes. This joint is held together principally by muscles; one of which is inserted into the superior margin of the glenoid cavity of the scapula, three into the larger tubercle of the humerus, and one into the lesser tubercle. The first of these muscles is the long head of the biceps, which enters the joint from the bicipital groove. The three next are the supra and infra spinatus, and the teres minor; and the last is the subscapularis. This arrangement, whilst it supports the capsular ligament, gives to the joint that variety of motion which it enjoys.

In what directions might the humerus be forced from its natural position by violence?

976. This bone may be dislocated in three directions principally; downwards into the axilla, forwards under the pectoral muscle, and backwards upon the infra-spinatus muscle; but of course the precise situation of the displacement cannot be defined, as this will vary according to the force applied. For

example, if a less degree of force be applied than would throw the bone under the pectoral muscle, it may be found resting on the outer side of the coracoid process of the scapula.

State the order of this dislocation, as it relates to the comparative frequency of its occurrence?

977. The luxation into the axilla is by far the most common, then that under the pectoral muscle, and lastly that upon the dorsum scapulæ, which very seldom happens.

Var. 1.—*Dislocatio in axillam.* Luxation into the arm-pit.

By what marks can the dislocation downwards be discovered?

978. This can, in most cases, be instantly ascertained at a single glance, by the change in the position of the axis of the humerus, which now leads to the axilla; by the want of the natural rotundity of the shoulder, occasioning a projection of the acromion, and a flattening of the deltoid muscle; by the patient not being able to raise his arm; but still more certainly by detecting the head of the bone in the axilla upon raising the arm from the side.

What muscles mostly oppose the reduction of this kind of dislocation?

979. The deltoid, supra and infra spinatus. — *Vide Sir Astley Cooper's Treatise, &c.*

In what direction should the arm be extended for reduction?

980. At a right angle with the body, or directly horizontally rather than obliquely downwards, as in this position of the limb the above muscles will be in a relaxed state. At the same time the elbow is to be slightly bent, in order to relax the biceps.

Were you called to a recent luxation of this kind, in a lonely situation, where but little assistance could be procured, what is the method of reduction that you would first employ?

981. I should proceed as follows:—" The patient should be placed in the recumbent posture, upon a table or sofa, near to the edge of which he is to be brought. The surgeon then binds a wetted roller round the arm, immediately above the elbow, upon which he ties a handkerchief. Then, with one foot resting upon the floor, he separates the patient's elbow from his side, and places the heel of his other foot in the axilla, receiving the head of the os humeri upon it, whilst he is himself in the half-sitting posture by the patient's side. He then draws the arm, by means of the handkerchief, steadily

for three or four minutes, when, under common circumstances, the head of the bone is easily replaced; but if more force be required, the handkerchief may be changed for a long towel, by which other persons may pull, the heel still remaining in the axilla."—*Sir Astley Cooper's Treatise.*

Should this method fail, and more strength be required, what method would you next employ?

982. The patient must be seated on a chair, and the scapula fixed by means of a round towel, or a thin sheet placed under the axilla, crossed upon the top of the shoulder, and then carried backwards on either side of the neck, for the purpose of being held by those who are to make counter-extension. A wet roller is then to be bound round the lower part of the upper arm, and upon this to be fastened the towel or shawl by which extension is to be made. "The arm should then be raised at right angles with the body, and if there be much difficulty in the reduction, it should be elevated above the horizontal line, more completely to relax the deltoid and supra-spinatus muscles. Two persons should then draw from the bandage affixed to the arm, and two from the scapula bandage, with a steady, equal, and combined force: jerking should be entirely avoided, and every aim at quick reduction should be discountenanced. '*Slowly and steadily*' should be the word of command from the surgeon, who, after the extension has been kept up for a few minutes, should place his knee in the axilla, resting his foot on the chair upon which the patient sits. He should then raise his knee, by extending his foot, and placing his right hand upon the acromion, push it downwards and inwards, when the head of the bone will usually slip into its natural position."—*Ibid.*

If from the resistance of the muscles, or the length of time the bone has been dislocated, this plan should fail of reduction, what other mode have you in reserve?

983. The method of reduction by pulleys. For their application, "the patient is seated between two staples, which are screwed into the wainscot on each side of him. The bandages are then applied precisely as in the former mode, in which the extension is performed by men, and the force is applied in the same direction. The surgeon should first draw the pulley, as the class of people, usually summoned to his assistance, being ignorant of the principle upon which it is employed, would use too great violence. He should draw gently and steadily until the patient begins to complain of pain, and then cease, keeping up the degree of extension, and

conversing with the patient, to direct his mind to other objects. In two or three minutes, more force should be applied, and continued until pain be again complained of, when the surgeon should again cease to increase the force; and thus he should proceed for a quarter of an hour, at intervals slightly rotating the limb. He should, when he has applied all the extension he thinks right, give the string of the pulley to an assistant, desiring the existing degree of extension to be supported. Then, putting his knee in the axilla, and resting his foot upon the chair, he should gently raise and push back the head of the bone towards the glenoid cavity, when the bone will pass into the socket. This takes place generally without the snap, which is heard when other means are employed; yet both the surgeon and the patient are aware of some motion at the head of the bone at the time. If the pulleys be thus employed, the extension will be conducted infinitely more steadily and effectually than when performed by men."—*Ibid.*

Is it an increase of force that you have in view in the employment of the pulleys?

984. Not so much an increase of power, as the steady and uniform manner in which it is applied.

Is there not hazard in using great force with the pulleys?

985. "When excessive, there is a risk of the axillary nerves and artery giving way: such accidents have happened, and been accompanied with serious and even fatal consequences; and from laceration of other tissues, the muscular, fibrous, or cellular, fatal inflammation and abscess have resulted. The surgeon is therefore called upon to exercise judgment and discretion; not to continue extension to a pernicious extent, and not to abandon attempts at reduction too soon, leaving his patient disabled for life."—*Liston's Elements.*

Should there be no fixed points in the sides of the apartment to receive a staple or screw, is there any other part of the apartment to which they could be fixed?

986. "In apartments, where it is not convenient to place the pulleys in the walls, I have fixed them in the floor, on each side of the patient, who must, under these circumstances, sit upon the floor."—*Sir Astley Cooper's Treatise.*

In how long a time after the accident has a luxated shoulder been reduced?

987. Luxations of the shoulder-joint may be, and have been, reduced after the lapse of two or three months; but the difficulty increases, and the chance of success diminishes,

in proportion to the time which has elapsed since the date of the accident.

In consulting on the propriety of an attempt at reduction, what are the circumstances that are to be considered?

988. "The patient's period of life, and his occupations—the state of the parts—the degree of motion that has been acquired—and the treatment, if any, which has been adopted. If the movements be to such an extent as to favour the supposition of the head of the bone having been furnished with a new recipient cavity, to which it has, in a great measure, accommodated itself, and that the glenoid cavity has, from disease, become altered, the surgeon can scarcely hope for advantage to his patient from attempts to break up the new articulating apparatus, and re-establish the old. The patient will be, most probably, put to a great deal of pain, and some danger, without experiencing improvement to the limb: indeed, the motions and power may prove less than before. In old men, too, force sufficient for reduction cannot be employed without great risk of laceration of nerves, blood-vessels, and muscles. But if the patient be young, the motions limited, and the articulation apparently not changed by solid effusion, reduction may be attempted with a fair prospect of success, and without injury. In all such cases, however, the surgeon must watch every step of the proceedings, and have sufficient experience to stop short of inflicting irreparable mischief. No standard can be fixed for the degree of force that is necessary and safe. He may be foiled, even after the most powerful efforts, in a dislocation of two or three weeks' duration; whilst, by the use of but slight force, he may succeed in one of as many months."—*Liston's Elements.*

By what means could you diminish the power of the resisting muscles, previously to an attempt at reduction, in a protracted case?

989. The patient should be bled, put into a warm bath at the temperature of 100 to 110 degrees, and be made to take one grain of tartarized antimony every ten minutes, till he becomes faint, when he should be removed from the bath, wrapped in a blanket, and placed in a chair for extension.

Should you fail to produce syncope by these means, what other remedy would you make use of?

990. The tobacco clyster; as this medicine "produces the most complete prostration of muscular power."—*Liston's Elements.*

What treatment is required after the bone has been reduced to its natural position?

991. In recent cases it will be sufficient to support the bone in its natural position by a proper bandage and a sling; but in cases of long standing, where it has been necessary to employ considerable force, inflammation should be moderated by local bleeding, cold lotions, and by purgatives.

VAR. 2 —*Dislocatio sub claviculâ.* Luxation beneath the clavicle.

What are the symptoms of this variety of the luxation of the humerus?

992. This variety is more easily perceived than the former. The axis of the limb is directed towards the middle of the clavicle, where, especially in thin persons, the head of the humerus can be distinctly felt, and its presence there can be proved by rotating the arm, when the protuberance will be seen to obey the motion.

In what manner would you reduce the displacement?

993. " In this, as in the former case, we can usually succeed in effecting reduction by placing the foot in the axilla, and by extending the arm in like manner; excepting that, in this dislocation, the foot is required to be brought more forward to press on the head of the bone, and the arm should be drawn obliquely downwards and a little backwards; but in those cases in which some days have elapsed before reduction has been attempted, continued extension will be necessary; and to employ it steadily and effectually the pulleys should be used. The same bandage is required as in the dislocation in the axilla, whether the power used be applied through the medium of pulleys, or directly by men. The arm should be bent to relax the biceps muscle; but the principal circumstance to be considered is the direction in which the bone is to be drawn, and the best direction is slightly downwards; for if it be drawn horizontally, the head of the os humeri is pulled against the coracoid process of the scapula, and a difficulty created, which may be avoided. The principle, upon which the pulley is employed, and the manner in which the extension is supported, is the same as in the dislocation into the axilla; but the direction is different, the arm being drawn obliquely downwards and backwards. The extension must be kept up longer than in the dislocation downwards, as the

resistance is greater; but as soon as the bone is felt to move from its situation, the surgeon should give the strings of the pulley to an assistant, and, putting his knee or heel against the head of the bone, at the fore part of the shoulder, should push it back towards the glenoid cavity: but this step is not of the smallest utility until the bone has been drawn below the level of the coracoid process; and whilst the surgeon is thus pressing the head of the bone backwards, he should pull the arm forwards from the elbow. This is the plan which I have found by far the most effectual in reducing the dislocation forwards."—*Sir Astley Cooper's Treatise, &c.*

VAR. 3.—*Dislocatio super dorsum scapulæ.* Luxation upon the back of the scapula.

What are the signs that distinguish this species of displacement?

994. The projection of the acromion, the flattening of the deltoid muscle, and the direction of the shaft of the humerus backwards towards a protuberance upon the dorsum scapulæ, occasioned by the head of the displaced bone.

In what way would you reduce a dislocation of the humerus backwards?

995. "The reduction is effected by elevating the arm, and rotating it outwards, so as to roll the head of the humerus towards the axilla: having brought it, as much as possible, to resemble a dislocation into the axilla, the operator must keep it in that direction, and at the same time bring down the arm in an horizontal direction; when, an extending force being applied, the bone will be readily reduced."—*Mr. Coley's Letter to Sir Astley Cooper, in his Treatise on Dislocations, &c.**

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* "The head of the bone is (sometimes) drawn forwards against the coracoid process: there is a depression opposite the back of the shoulder-joint, and the posterior half of the glenoid cavity is perceptible from the advance of the head of the bone: the axis of the arm is thrown inwards and forwards: the inferior motions of the limb are still capable of being performed, but its elevation is prevented by the head of the humerus striking against the coracoid process: there is an evident protuberance formed by the head of the bone in its new situation, which is felt evidently to roll, when the arm is rotated."—*Sir Astley Cooper's Treatise, &c.*

The treatment of this case is the same as that recommended in the luxation beneath the pectoral muscle.—*Vide* 993.

Other methods of reducing a luxated shoulder are occasionally practised. A recent dislocation into the arm-pit may sometimes be reduced by the surgeon placing his knee in the axilla of the patient, and extending the

The extension is to be made in the same direction as recommended in luxation into the axilla.—*Vide* 982.

SPECIES 2.—*Dislocatio humeri composita.* Compound dislocation of the humerus.

What is the treatment of a compound luxation of the humerus; that is, when the displaced bone is forced by extreme violence through the integuments?

996. Such a formidable case requires immediate reduction. "When the bone is replaced, lint dipped in blood is to be applied to the wound; or if the wound be large, a suture should be employed, and then the lint applied: adhesive plaister should be used to support approximation, and the limb should be kept close to the side by means of a roller placed round the body, including the arm, and thus preventing the least motion of the head of bone: by these means the suppurative inflammation may be prevented, and the cure may proceed without protracted suffering, or any danger to the patient's life."—*Sir Astley Cooper's Treatise, &c.*

GENUS 2.—*Fractura.* Fracture.

SPECIES 1.—*Fractura simplex.* Simple fracture.

VAR. 1.—*Fractura articulationis humeri.* Fracture of the shoulder-joint.

What is the best mode of ascertaining that a fracture has taken place within the shoulder-joint?

997. In this case "the patient is unable to raise his arm,

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dislocated limb over it, on the principle of the lever. Mr. Hooper, of ——— near Worcester, whilst he was assisting me in my practice, reduced a dislocation forwards in a very clever manner. The scapula being fixed, and a round towel being attached to the arm above the elbow, he placed himself within the other extremity of the towel, and kept up extension with the weight of his body against it, till he had overcome the resistance of the muscles, and reduced the bone.

Before taking leave of the important subject of dislocations of the shoulder, I would strongly impress upon the mind of the young surgeon the necessity of paying great attention to the diagnosis of injuries of the shoulder, lest in a moment of indifference he might suffer a luxation of the humerus to pass undiscovered, and (what is worse) unreduced; an omission which must, in a great degree, cripple the patient, and tarnish, if not destroy, his own reputation; and lest, from a want of due investigation, he should mistake fracture for dislocation, and use extension and force to the suffering and danger of the patient under his care.

though with great pain it can be placed in any position that it occupies naturally: it can be abducted and raised perhaps to a greater extent and more readily than when sound.

"The shoulder is flattened, and the limb apparently lengthened. The elbow is readily put to the side. On raising the humerus, rotating it, and moving it to and fro, crepitation is distinctly perceived; but not so readily after swelling has taken place. The swelling also obscures the appearances observed immediately after the infliction of the injury, the flattening of the shoulder, and the apparent elongation of the arm.

"By the fingers of one hand, passed deep into the axilla, the head of the humerus can be discovered; and on rotating the shaft of the bone with the other hand, grasping the elbow, and pushing upwards at the same time, crepitation is perceived, and the upper portion of the bone is ascertained to be unaffected by the rotation of the shaft. The nature of the injury is then sufficiently apparent,"—*(Liston's Elements)*; viz. that there is fracture of the head or neck of the humerus: but should the crepitation be deeper, and less distinctly felt by the hand in the axilla, "the surgeon is warranted in believing that the glenoid cavity has suffered, and that it has been probably broken into fragments."—*Vide ibid.*

What mode of treatment does this case require?

998. "Fractures of the glenoid cavity, the neck of the scapula, and the neck of the humerus, are all treated by the same simple, though effectual, apparatus, as employed for injuries of the clavicle."—*(Vide* 958.*)* If the parts are at once placed in apposition, and accurately retained, no abstraction of blood, either general or local, is required at the time, and is not likely to be called for during any stage of the treatment."—*Liston's Elements.*

Is it possible for a fracture of the neck of the humerus to coexist with dislocation of the shoulder-joint?

999. Such a coincidence is extremely rare, and it is difficult to imagine how an accident of this kind could take place at the same time; yet several cases are on record in proof of the fact.

How could you discover the reality of such an instance?

1000. The dislocation may be discovered by the projection of the acromion, the flattening of the shoulder, and by the tumor formed by the head of the humerus, whether beneath the pectoral muscle, in the axilla, or upon the dorsum scapulæ; and the fracture may be detected, if not by crepitation, by the possibility of moving the shaft of the bone in any direction, and by being able to feel the fractured end of the humerus, when tilted upwards through the deltoid muscle.

What treatment does this case require?

1001. The dislocation is irremediable. The fracture must be treated by "applying a roller from the elbow to the shoulder-joint, by placing a splint on the inner and the outer side of the arm," (the latter long enough to reach from the external condyle to the acromion,) "and by confining these by means of a roller."—*Sir Astley Cooper's Treatise.* If the luxation be backwards or forwards, a cushion should be placed in the axilla, to throw out the fractured end of the bone; but if downwards, the cushion will be unnecessary. The arm must be supported in a sling.

VAR. 2.—*Fractura columnæ humeri.* Fracture of the shaft of the humerus.

What are the characters of a fracture of the shaft of the humerus?

1002. This fracture is either oblique or transverse, and there is considerable displacement. "The limb is always shortened to a certain extent, and the natural contour destroyed. The arm is useless, and bent towards the trunk, and the muscles are in a state of spasmodic contraction. The nature of the injury is at once most readily recognized. There is unusual and unnatural mobility of the arm, and distinct crepitation at the fractured point."—(*Liston's Elements.*) And these circumstances are accompanied with bloody swelling, as takes place in most fractures.

What are the characters of a fracture of the inferior part of the shaft?

1003. "When the inferior part of the shaft is broken, there is less displacement than when the fracture is towards the middle of the bone. Fracture above the condyles sometimes extends through these; and the one may be detached from the other either with or without fracture of the shaft. When such an accident is suspected, the position of the condyles in regard to the ends of the bones of the fore-arm should be accurately observed. Flexion and extension of the fore-arm can be readily performed, though with pain; not so, when the bones are luxated. Crepitation is detected along the line of the fracture, during motion of the limb, and when the condyles are laid hold of, and moved upon each other, or on the shaft."*—*Ibid.*

What is the treatment of fracture of the shaft of the humerus?

1004. "In fracture of the middle of the shaft, coaptation is easily accomplished; slight extension is made, by one hand grasping the elbow, whilst by the other the bones are brought together, and the straightness and outline of the limb restored. The proper position is readily maintained by two splints of bookbinder's pasteboard, one applied from over the acromion process to beyond the point of the elbow, the other from the axilla, and also passing over the elbow on the inside. Thus the neighbouring joints are fixed, and the muscles rendered inactive. The conjoined breadth of the splints should be sufficient to embrace the limb almost entirely, some space being left, so that when the swelling subsides they may neither meet, and consequently lie loose, nor overlap each other."—*Liston's Elements.*

The splints may be softened with hot water, in order that they may accommodate themselves to the shape of the limb.

But would the pasteboard, moistened in this manner, be a sufficient support to maintain the bones in apposition?

1005. No; and therefore, after having applied a roller around the limb from the points of the fingers to the shoulder, in order to retain the pasteboard splints it will be necessary "to place a wooden splint on the outside, retained by an additional bandage, so as to steady the parts till the pasteboard has dried, and formed a firm mould or case for the limb. Then the wood is unnecessary, and should be removed." This being done, "the fore-arm is bent at right angles, and the humerus fixed to the trunk."—*Ibid.*

Does fracture at the distal end of the humerus require a different treatment?

1006. Fracture at the distal end of the humerus is managed most conveniently with the limb in the straight position. The fragments are placed accurately together; one splint is placed on the fore part, and another posteriorly. The fore-arm is kept in a state of supination.

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* Transverse fracture of the shaft, just above the condyles, is not uncommon in young persons. It is readily detected by the projection of the fractured end of the shaft against the integuments, in consequence of the condyles being drawn upwards by the action of the triceps muscle. I have met with several instances of this kind, and havs always found it extremely difficult to maintain the natural position of the bones.

Species II.—*Fractura composita.* Compound fracture.

Var. 1.—*Fractura articulationis humeri composita.* Compound fracture of the shoulder-joint.

What are the circumstances by which you could discover a compound fracture of the shoulder-joint, occasioned by gun-shot?

1007. This case will generally be sufficiently evident by the situation of the external wound, by the appearance of splintered bone, and by crepitation: it may also be ascertained by a careful investigation of the orifices through which the ball might have passed.

But might not there be compound fracture of the joint from this cause, without the possibility of feeling crepitation?

1008. Yes; a musket-ball may pass clean through the head of the humerus without splintering the bone, in which case there could be no crepitation felt. The ease or difficulty of the diagnosis will of course depend on the kind of fracture the injury has occasioned. If the joint be broken into fragments, the case will be immediately manifest. If the ball shall have occasioned a less apparent injury of the humerus, without destroying its shape, our conclusion will be more difficult.

What treatment is required in a compound fracture of the shoulder-joint?

1009. The treatment of such a wound must ever depend on the degree of injury the joint has sustained. Some cases will demand immediate amputation, others the excision of the head of the humerus, whilst other less severe wounds of this kind we shall be justified in exempting from such decided measures.

State the characters of each degree of compound fracture of this joint, and the treatment, that each shall require; viz. of the degree, that shall require no operation; of the degree, that shall require excision of the head of the humerus; and of the degree, that shall demand immediate amputation.

1010. " The distinction," says Mr. Guthrie, when speaking of amputation at the shoulder-joint, " between the necessity of the operation, and the possibility of avoiding it, requires, in many cases, the exercise of the nicest judgment, and a due consideration of attending circumstances; for there is no part of military surgery in which an operation can be performed with more advantage at the instant, or delayed for a few days, with the view of gaining information, with more prejudice." It is indispensable, therefore, that the statement required should be made with the greatest possible care.

First, then, " a wound from a musket-ball, where there is *only* some *partial* injury of the bone, may be left to be disposed of by natural process, as these cases frequently do well, and the patient preserves the use of the fore-arm."—*Guthrie on Gun-shot Wounds, &c.* page 345.

Secondly, " I recommend excision of the head of the humerus only under the following circumstances : where the head of the bone is destroyed by a musket-ball, with one or two small openings, the ball having passed fairly through, or that it remains sticking in the head of the bone : but I conceive it essential to the success of the operation that the body of the humerus should not be splintered, or even have one or more fissures extending in its length."—*Guthrie on Gun-shot Wounds.*

" If the head of the humerus is the only part injured, or if the injury does not spread to any extent along the shaft, it certainly becomes the duty of the surgeon to attempt to save the limb."—*Hennen's Principles of Military Surgery.*

But Dr. Hennen thinks that before we proceed to excise the head of the bone with that view, that the probable state of the shaft ought to be deliberately considered ; and that, should there be any doubt of its integrity, it would be right to take into our consideration, whether it would not be most prudent to let the removal of the head of the bone be always a secondary operation.

Thirdly, " Injuries from musket-balls, penetrating the capsular ligament, attended with fracture and destruction of the head and adjacent parts of the humerus, and wounding the axillary artery, require immediate operation."—*Guthrie on Gun-shot Wounds.*

Again, " if the wound and splinters of bone point out the head of the humerus to be totally destroyed, with fracture extending to its body, the operation ought to be performed, and the patient's future health preserved, in preference to the chance of an anchylosis taking place at the end of many months, with its destruction."—*Ibid.*

" Extensive injuries of the joints form an urgent class of cases for immediate amputation." " I am well aware," says Dr. Hennen, " that some very favourable joint cases have ended successfully, without removing the limb; but I will venture to assert, that the pain and inconvenience of the cure, the subsequent inability of the member, and its proneness to disease, have infinitely counterbalanced the benefit derived from saving it."—*Hennen's Principles, &c.*

The description you have given of compound fractures of the shoulder-joint not demanding operation, is by no means sufficiently defined, and requires to be further illustrated.

1011. Mr. Guthrie, from whose work the citation was principally taken, seems to be aware of this, when he says immediately afterwards, "There is, however, some difficulty in ascertaining this circumstance (partial injury of the bone,) to have taken place, even with a careful examination, as sufficient injury may have occurred within the capsular ligament to cause the bone to exfoliate, without being so obvious as to be immediately detected, or to indicate the necessity of any operation; and as every exertion or motion of the part adds to the mischief already committed, it is advisable, even on the suspicion of such injuries, to desist from further examination, and treat the case as a simple one; being one of those that ought to be deferred, until the subsequent processes of nature have pointed out the extent of the mischief, and her inability to overcome it."—*Guthrie on Gun-shot Wounds.*

Dr. Hennen may be quoted in illustration of this point. "If the ball has only struck, fractured, or otherwise injured the head of the bone, without extensive laceration of the capsular ligament, injury to the great vessels or nerves, &c., the surgeon would be utterly unjustifiable, either in the amputation on the field, by a joint operation, or in the excision of any part of it."—*Principles of Military Surgery.*

What treatment does a wound of this kind require?

1012. "The rule of practice in general, where the ball passes out with little injury to the bone, is, I think, to enlarge the wound in the first instance, to allow of moderate examination by the point of the finger, if it cannot be done by the openings already formed. The most energetic antiphlogistic regimen is to be enforced, until suppuration is established; a clear depending opening is to be formed, if it do not exist, for the matter to be discharged, and any pieces of bone that appear loose are to be gently removed. The joint is not to be wantonly cut into at first, to see how much bone may be injured, but it is to be cut into, if necessary, to allow any piece of bone to be removed, that may become loose, and cannot be easily extracted. The principal point to attend to is the prevention of sinuses round the joint, as they would ultimately prove fatal."—*Guthrie on Gun-shot Wounds.*

But of what use would the enlargement of the wound be in a case which you consider to be of a favourable kind?

1013. To enable me to examine the nature of the injury as accurately, though at the same time as cautiously, as possible, lest I might have mistaken an injury, that might demand excision or amputation, for one, that I supposed required neither.

Describe the operation for excision of the head of the humerus.

1014. "I make an incision in the centre of the deltoid muscle, parallel to its fibres, carrying it downwards as far as possible, and separating the edges of the wound to show the joint, the capsular ligament of which is generally open; with the curved blunt-pointed bistoury I readily cut the attachments of the supra-spinatus, infra-spinatus, teres minor, subscapularis, and the long head of the biceps. I then disengage the head of the bone, and turn it out through the incision, by pushing it from below with my fingers, or by any appropriate lever. The arm is then to be approximated to the shoulder, and retained in position by a proper bandage and sling."—*Baron Larrey's Work on Military Surgery.*

Might any circumstances induce you to vary this mode of operating?

1015. Should there be any suspicion, that the shaft of the bone may be fissured, I should be induced to make the incision for extraction in such a direction, as would allow of its being converted into the operation of amputation, if required from the examination of the state of the bone.

What blood-vessels are endangered by the operation for excision?

1016. The axillary, the anterior and posterior circumflex arteries.

State the relative position of these arteries to the insertion of the muscles you are obliged to divide.

1017. The axillary artery takes its course between the subscapularis and serratas major muscles, where it is surrounded by the lymphatic glands and fat, by the veins, and also by the large nerves, which form the brachial plexus.

The anterior circumflex artery "is sent off from the axillary, between the subscapularis and teres major. It passes in a transverse direction, between the heads of the coraco-brachialis and biceps, and body of the os humeri, immediately below the joint of the humerus. It is dispersed upon the muscles which cover it, and upon the periosteum and capsular ligament of the joint."

The posterior circumflex is a large artery, and "passes first between the subscapularis and teres major, and then turns round between the back part of the os humeri and long head of the triceps and the deltoides. It sends branches to the periosteum and joint, to the short head of the biceps and coraco-brachialis, to the triceps and subscapularis, and runs in a circular manner to the deltoides."—*Fife.*

How could you avoid wounding these vessels in detaching the muscles from the head of the bone?

1018. The axillary trunk may be avoided by "taking care to keep the cutting-edge of the instrument next the bone, and the back towards the artery. The posterior circumflex will be avoided, if, in dividing the attachment of the teres minor, care be taken to keep the knife close to the head of the bone; and the same rule obtains in dividing the attachments of the subscapularis and supra-spinatus, with the view to avoid the trunk of the anterior circumflex."—*Guthrie on Gun-shot Wounds.*

The surgeon will be much assisted by feeling, before he makes his incisions, for the pulsations of these arteries. With due attention to these rules, Mr. Guthrie says that "where the single incision is used, no vessel of any consequence will bleed."

In a case requiring amputation at the shoulder-joint, when would you perform the operation—immediately after the reception of the injury, or after consequent inflammation shall have subsided?

1019. As soon as possible after the injury has been received; as the early, or field operation, has been found, in military practice, to be by far the most successful. In proof of this, out of nineteen amputations at the shoulder-joint in the field, during the latter part of the peninsular campaign, eighteen were cured; and of the same number operated upon it in general hospitals, fifteen died. "All delay," says Mr. Cooper, "is improper, beyond the short period, during which the faintness, immediately arising from the injury, usually lasts."—*Dictionary of Practical Surgery.*

In what manner would you command the circulation before you proceed to operate?

1020. By making pressure upon the subclavian or axillary artery; and I should select an able assistant for this purpose.

In what situations can such compression be most conveniently and effectually made, and by what means?

1021. Mr. Guthrie observes, "as there cannot be a doubt of the possibility of compressing the subclavian artery above the clavicle, without inconvenience to the patient, and with perfect safety, it becomes the most eligible place, as the assistant, who performs this duty, is out of the way of the operator, and has the complete command of his instrument and the artery." The instrument, here alluded to by Mr. Guthrie, is the handle of the common screw tourniquet, padded with lint, to take off the sharpness of the edges; and the pad may be fastened on the handle by the strap being bound over it, as in the mode of packing up the instrument. The pad may be further steadied by carrying the remainder of the strap across the folds and around the screw of the tourniquet, which will make it a very commodious and safe means for compressing the artery. As a general rule, with an instrument of this kind the artery may be compressed above the clavicle, about "midway between the acromion process and sternum; below the clavicle, it should be from a quarter to half an inch more outward towards the acromion."

Dr. Hennen says, with reference to this question, "The point is incontrovertibly settled; the vessel can be compressed, as it runs over the first rib, with the greatest certainty, and by an expert assistant with the utmost ease."

Would you not satisfy yourself, that by these means the circulation could be controlled, before you entrusted the compression to an assistant, however able he may be?

1022. Certainly; no surgeon ought to commence the operation before he has personally assured himself of this fact.

When ought the compression to be made?

1023. "Where the circulation is to be commanded by the pressure from the hand of an assistant, there is not only no necessity for the application of the key, boot-hook, or tourniquet handle, usually employed, previously to beginning the operation; but it is actually hurtful. The long-continued pressure is excruciating to the patient, and is often more the subject of his complaint than any other step of the business. It is also fatiguing to the assistant, who, by this means, begins to flag at the moment his strength and activity are most required."—*Hennen's Principles.*

Let the assistant first try his power of compression, before the operation has commenced, and let him with his eye mark the precise spot well: during the external incisions, the pressure need not, in the smallest degree, approach to violence. When the surgeon is about to make his dismembering cut, or that which, in removing the bone from the socket, divides the artery, firm, steady, and even powerful pressure, will be required for the fourth of a minute, (*Ibid.*) or as long as may be necessary for securing the vessel, "which almost always protrudes into the surgeon's fingers." Mr. Guthrie considers it of little consequence, whether the vessel be compressed or not prior to its division.

In what position should the arm of the patient be held for the operation?

1024. The arm should be raised to near a right angle with the body, which will enable the operator to examine the axilla, and ascertain if the artery can be compressed by the assistant.

Describe the operation of amputation at the shoulder-joint.

1025. "To perform amputation at the shoulder-joint, I have for some time exclusively employed the mode by a flap, formed from the acromion to the centre of the axilla on each side by a gentle curve, first through the skin and cellular substance on the outside of the arm, then on the inner, so as to mark the flap and guide the future strokes of the knife; then, with a middle-sized amputating knife, I cut nearly down to the bone on each side. I then, taking the pointed slip of deltoid which remains attached to the acromion, lay it down quickly with a scalpel, so as to expose the head of the bone, which I now proceed to luxate: this is done with the greatest ease and certainty by throwing the shattered remains of the arm backward, and thus exposing the long head of the tendon of the biceps: by dividing this tendon and running the scalpel fairly along the groove, its back lying in it as in a director, we are at once conducted into the joint." "By carrying the scalpel fairly round, the capsular ligament is divided from the bone. Resuming the amputating knife, with one sweep in the axilla the two lateral flaps are united, and the limb removed." —*Hennen's Principles, &c.*

What number of arteries are usually tied in this operation?

1026. Mr. Guthrie says, "In recent cases of injury, I have seldom had occasion to take up more than three arteries, and no cutaneous or other vessels besides those, divided by the last incision;" but the number of arteries will depend upon the vascular distribution peculiar to the individual.

Having removed the shattered limb, state what remains to be done.

1027. First, The vessels are to be secured. The axillary artery, which will be found amongst the plexus of nerves in the lower third of the wound, should be tied with a ligature of two good threads. "All pressure being now removed, the anterior and posterior circumflex arteries will bleed, and must be secured." The axillary vein, if it bleed, should be also secured by a single ligature. This being done, and all hemorrhage controlled, we cleanse the wound, and remove with the scissars any portions of nerves, tendons, or capsular ligament, which may be hanging loose, and which may impede union; but the glenoid cavity ought not to be deprived of its cartilaginous surface. The sides of the wound are now to be brought together with a suture, passed through the skin lying over the pectoralis major muscle, and the whole must be "supported by strips of adhesive plaister and bandage, the ligatures being brought out direct."—*Guthrie on Gunshot Wounds.*

What are the advantages of the direction of the incisions from the acromion to the axilla?

1028. "The incision then forms but one line from the acromion downwards, curving at the bottom to the fore part of the chest, the skin at the axilla being always a little wrinkled, and much inclined to retract. The flaps of the deltoid meet firmly, sink a little into the hollow under the acromion, lie close upon the glenoid cavity and the coracoid process; and from the pressure of the adhesive plaister and compress, with the evenness of the wound, the skin of this part nearly unites by the first intention; the hollow round the glenoid cavity is comparatively small to what might be expected, and the consolidation in healthy subjects, where every thing has done well, goes on steadily, so as not to leave any cause of future inconvenience."—*Ibid.*

Should it be impracticable to form the flaps in this direction, from what other situation could they be derived?

1029. "If," says Mr. Guthrie, "integuments cannot be saved from one point, they can from another, or from two or three different places, and be made to meet in apposition afterwards; or if none can be procured any where, the artery must be secured fairly on the face of the wound, a slight compress laid on its course to give support, the wound dressed lightly, and the rising inflammation prevented or allayed by cold applications."—*Ibid.*

VAR. 2.—*Fractura columnæ humeri composita.* Compound fracture of the shaft of the humerus.

What is understood by a compound fracture?

1030. A compound fracture is signified when the fractured end of the bone is protruded through the skin, or when there is an external wound communicating with the fracture.

Are not injuries at this part of the upper extremity attended with less hazard than similar injuries inflicted upon any other part of the extremities?

1031. Yes; "more serious wounds may be inflicted in this space (between the insertion of the pectoralis major and the elbow-joint) and the arm preserved, than in any other part of the extremities, arising from the great command the surgeon has over it, from the bone being single, and its state capable of being distinguished with tolerable accuracy during the continuance of the complaint, from the muscles being few in number, and the interstices between them consequently less numerous, and from the great vessels being totally in our power."—*Guthrie on Gun-shot Wounds.*

Do compound fractures of the shaft of the humerus frequently require amputation?

1032 No; "Considering the great frequency of wounds in this part of the arm, attended with fracture, amputation, as a primary operation, is but seldom required; and a just delay, to ascertain what nature, assisted by art, can do, is prudent."—*Ibid.*

State those compound injuries of the shaft of the humerus that admit of the preservative treatment.

1033. 1st. Where the bone is merely broken in two parts, and protrudes through a simple incised or lacerated wound, without further injuries of the soft parts.

2dly. Where the bone has been broken into several fragments, with contused and lacerated state of the soft parts, provided the artery be entire.

3dly. "A musket-ball passing through the centre of the os brachii, with considerable splinterings of bone, provided they do not reach as far as either of the joints, does not require the primary operation." "And this rule of practice is so general among military surgeons, that I believe no one of experience or surgical knowledge has ever proposed amputation in a case of this kind during the Peninsular war, without other particular reasons."—*Ibid.*

4thly. If the artery "be wounded with merely a splintering of the bone, without complete solution of its continuity, or even if it be broken short across with little or no splintering, the vessel should be secured above and below, and the event carefully watched."*—*Ibid.*

State those cases of compound fracture of the shaft of the humerus that demand immediate amputation.

1034. 1st. Amputation is required in compound fractures, in which the bone is comminuted, and the soft parts are extensively lacerated and contused. An injury of this kind may be caused by pressure of the wheel of a loaded waggon.

2dly. "If the artery be wounded with an extensive fracture, the operation is imperious."—*Ibid.*

3dly. "If the bone be mashed with the muscles by an oblique stroke of a round shot, or the fore-arm be destroyed or carried away, amputation is required immediately."—*Ibid.*

What is the treatment of a compound fracture, in which the bone protrudes through the skin?

1035. The fracture being reduced in the manner recommended at 1004, the lips of the wound are to be brought together by strips of adhesive plaister, &c., and the bones held in coaptation by splints, as in the simple fracture (1004-1005.) "The patient is then placed on his back in bed, and the splints are retained by slips of bandage, double, one end being passed through the loop and secured to the other by a running noose. This method of deligation affords facility for the removal of the splints, in order to examine into the state of the limb and dress the wound."—*Liston's Elements.*

Should it be impracticable to reduce the protruded bone by extension alone, would you remove it by the saw, or replace it by an incision?

1036. If the protruded bone be extremely sharp-pointed, it may be removed by the saw; but if otherwise, it will be best to replace it by enlarging the wound.

What is the primary treatment of a compound fracture of the shaft of the humerus, in which the bone is broken into fragments,

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* Mr. Guthrie does not bring any case in support of this injury being left to nature, yet he thinks the surgeon would be justified in including it within the preservative treatment. Should such treatment be successful, it must be imputed to the free anastomosis, that takes place between the branches of the brachial and those of the ulnar and radial arteries.

with contusion of the soft parts, but from the artery not being wounded, not requiring immediate amputation?

1037. The patient being put to bed, and the arm laid on a pillow, such fragments, as may be loose and detached, are to be carefully removed. The fractured parts are then to be brought into the best possible coaptation, and supported by proper dressings, bandages, and splints.

What bandage is most suitable for a case of this kind?

1038. It should be upon the principle of the many-tailed bandage, but less complex. The following will be found at once simple and practical. Let portions of old linen, about two inches and a half wide, and more than long enough to encircle the limb, be cut out and tacked together. As many of these as may be sufficient to comprise the extent of the injury, being made wet with cold lotion, are to be spread smoothly beneath the limb, and then be made to embrace the fracture in the same manner as the many-tailed bandage. This method will require less time in the application, and give more support.

With what degree of tightness ought the strapping and the bandage to be applied?

1039. In a case of this kind we ought to be most careful not to use any force in retaining the fracture in coaptation, lest we destroy the vitality of the contused soft parts, and cause sloughing. Mr. Hammick may be advantageously quoted on this point. "Never use any violence in bringing into contact torn-up integuments; let them be coaxed gently together, or as near as they can be, and retain them by the simplest means: let your bandages be applied with the view of support, not compression."—*Practical Remarks on Amputation, Fractures, &c.*

State the immediate treatment of a fracture of the shaft, where a musket-ball has passed through the centre of the humerus, with considerable splinterings of the bone.

1040. Should the shaft of the bone be broken asunder, all the splinters within our reach must be removed, and the case subjected to the same treatment as is laid down at 1037; but if the shaft be perforated only, the orifices should be lightly dressed, and the limb supported by bandage. The patient need not be kept in bed.

What would be your treatment, should the ball be found to have lodged in the shaft of the bone?

1041. "In some severe cases, where the ball lodges in the bone, particularly about the condyles, by making deep and cautious incisions before great swelling of the soft parts comes on, we may occasionally succeed in removing the metallic mass with a forceps or elevator, either unaltered or beat out into an irregularly angular shape. Sometimes, however, it is so firmly fixed, that it can be removed only by sawing the bone with the crown of the trephine, or other instrument. The accident is always highly serious; but it is possible, under circumstances of peculiarly good fortune, in a temperate subject of sound constitution, to save the limb by the operation." —*Hennen's Principles of Military Surgery.*

What is the treatment, if the shaft of the bone be merely splintered, or simply broken across, and the brachial artery be wounded at the same time?

1042. "If the vessel have thrown its blood directly out at the wound, without injecting the cellular membrane, it should be tied above and below; but if pressure has been inconsiderately made upon the wound, and the arm injected with blood, it is very disadvantageous, and in a case of injured bone would determine for amputation."—*Guthrie on Gun-shot Wounds.*

What antiphlogistic measures are required along with the preservative treatment, which you have recommended for compound fractures of the shaft of the humerus?

1043. The measures to be adopted must depend on the state and effects of the injury. Should inflammation have taken place and caused symptomatic fever, general and local bleeding, &c. &c. may be necessary, always bearing in mind not to deplete the system too much in these severe cases, lest thereby the constitution be so weakened as not to be able to bear the discharges about to follow; but should the accident have only just occurred, it will be sufficient to keep the parts well wet with cold water, poured on the compresses.

Would cold water be suitable to every case of this kind?

1044. "No. Cold does no good in any stage of inflammation, when the sensation, accruing from the first application of it, is not agreeable to the feelings of the patient; when, in fact, it does not give relief; for if it produces a sensation of shivering, or an uncomfortable feeling of any kind, with stiffness of the part, it is doing harm, and a change to the genial sensation of warmth will not only prove more agreeable, but more advantageous."—*Ibid.*

"Nor ought cold applications ever to be continued, where the torpor, low temperature, and languid circulation in the limb, indicate a risk of gangrene. Hence, when a principal artery is tied, their employment is always wrong and hazardous."—*Cooper's Dictionary.*

Should the case be such as to require the primary amputation, how long would you wait before its performance?

1045. "Till the first moments of agitation have passed away, a period extending from one to six, or eight hours, according to the difference of constitution, and the different injuries that have been sustained. But from one to three hours will in most cases be found sufficient."—*Guthrie on Gun-shot Wounds.*

Is there any exception to this rule?

1046. Yes; In cases where the limb has been torn off by a cannon-shot, amputation should be performed *immediately*, without any delay whatsoever; "for although the patient may appear unable to bear it, the shock of the operation will not be equal to the continuance of the suffering he is undergoing, which would soon prove fatal."—*Ibid.*

What modes of amputation are best suited to injuries of the upper arm?

1047. Should it be necessary to saw the bone above the insertion of the pectoralis major muscle, the flap operation should be adopted; if it can be done below this point, the circular incision is to be practised.

Describe the manner in which the flap operation should be performed.

1048. "The patient is to be seated, and compression made upon the subclavian artery, in the same manner, and with the same instrument, as in amputation at the shoulder, in preference to using a tourniquet with a pad in the axilla, which is a source of great inconvenience in every step of the operation: (*Vide* 1021) two incisions of a similar shape are to be commenced, one or two fingers' breadth below the acromion, as the case may require; the point of the inner one, instead of ceasing, as in the operation of the shoulder, a little below the pectoral muscle, is to be carried directly across the under part to meet the point of the outer incision; so that the under part of the arm is cut by a circular incision, the upper in the same manner as in the operation at the shoulder: these incisions are only through the skin and cellular membrane, which has liberty to retract, but is not to be turned up. The deltoid and pectoralis major are then divided close to the inner incision, and the opposite portion of the deltoid, with the long head of the biceps, on the outside, for the extent of the outer incision. A half circular cut on the under part, in the line of the skin down to the bone, clears it underneath, and shews the artery retracting with its open mouth, which is at this moment advantageously pulled out by a tenaculum, and secured. The flaps are turned outwards and inwards, and particularly the outer one, until the bone is cleared to the spot of election for sawing, which is then readily effected from the outside, without danger of doing mischief. The tendons of the latissimus dorsi and the teres major, inserted on the outer part, need not be cleared away too carefully, as they materially help to keep the bone steady under the motion of the saw, and effectually prevent its splintering. There are few or no vessels to tie: the flaps are brought forwards and upwards, and perfectly cover the stump; one suture below the end of the bone keeps the parts together, which form nearly a line from the acromion downwards."—*Ibid.*

Sabatier advises the following method:—"With a straight bistoury the surgeon is to make a transverse incision down to the bone, a little above the lower extremity of the deltoid muscle. Two other longitudinal incisions, made along the front and back edge of this muscle, now form a flap, which must be detached and reflected. Lastly, the rest of the soft parts of the limb are to be divided by a circular cut, made on a level with the base of the flap, and the operation finished like a common amputation."—*Médecine Operative.*

Before the performance of the circular operation, at what point ought the tourniquet to be applied?

1049. "The tourniquet is to be applied in the usual manner, with a small pad in the axilla, with the screw above the acromion; it being advisable to have the strap acting as far distant as possible from the muscles and skin to be divided, that free retraction may take place, and no impediment be offered by the pressure of the tourniquet on the soft parts, while retracting them for sawing the bone."—*Ibid.*

But will it not be best sometimes to operate without the use of the tourniquet?

"If the surgeon have the slightest confidence in himself, and the assistants are good, no tourniquet should be applied, but the artery be compressed against the bone by the two forefingers."—*Ibid.*

Describe the mode of performing the operation.

1050. The patient being properly supported on a chair, and the integuments being put on the stretch above and below by two assistants, a circular incision through the integuments is to be completed by one continued cut with the amputating knife, lightly held between the thumb, index and middle finger, in such a manner, that in finishing the incision the handle may pass between the thumb and index; for if the handle be grasped by the whole hand, it will be difficult to complete the circle without a second application of the knife. The cellular membrane is now to be divided with a few touches of the knife, to admit of sufficient retraction of the skin by the assistant in charge of the upper part of the arm. The muscles are next to be divided down to the bone, with the knife placed close to the edge of the retracted integuments, and directed obliquely upwards and inwards; but should any part of the muscle remain undivided, it will be of course necessary to repeat the incision.

"The amputating knife being changed for a strong scalpel, the muscles are to be cleared from the bone for an inch and a half, or two inches, as the thinness or wasting of the part may require, for the sake of covering, as no injury can arise from the bone being short, and conical stumps frequently occur from its being too long. The retractor is to be applied, and the periosteum to be divided by one circle drawn with the scalpel round the bone, and in this circle the saw is to work, until the bone be divided. The retractor is to be removed, and the brachial artery drawn fairly out with a tenaculum, and tied. It will be found on the inner side of the arm. If it should have retracted out of sight, the finger, on the vessel above it, is to be raised, or the tourniquet is to be loosened, when it will show itself, with perhaps two or three other vessels, which must be secured. The surface of the wound is to be washed clean with cold water, the integuments dried with a cloth, and the stump dressed."—*Guthrie on Gun-shot Wounds.*

What precautions ought to be taken in order to prevent secondary hemorrhage?

1051. The face of the stump must be accurately examined, and the more so if fewer arteries have required being tied than is usual; for you will often upon a close examination "detect arteries, (says Mr. Hammick,) of the second and third order, occasionally protruding beyond the muscular parts at least the length of an eighth or a quarter of an inch, pulsating violently, though without any flow of blood. Their mouths on close inspection appear shut, with their ends forming an obtuse point; and this happens more frequently in very muscular subjects, where the operation has been very dexterously performed. Now should you pass over these arteries without securing them, you will find that within six hours of the patient having been returned to bed, by the muscular parts relaxing from the return of warmth, hemorrhage will pour forth from these vessels. You had better in all such cases snip off the end of the projection, and immediately a start of blood will take place, convincing you of the necessity of tying the artery before you have closed your stump."—*Practical Remarks on Amputations, &c.*

Should the patient be losing a considerable quantity of blood from a vein, would you not secure the vessel?

1052. If a large vein continue to pour out much blood, it must be secured, and this will be best effected by the needle; but in this mode of applying a ligature the greatest care must be taken not to include any branch of a nerve.

GENUS 3.—*Vulnus proprium.* Wound occurring to the upper arm.

Describe the course of the brachial artery.

1053. "The brachial artery" says Dr. Quain, "is placed along the internal and anterior aspect of the arm, extending from the lower border of the axilla to about a finger's breadth below the bend of the elbow. Its direction is downwards, outwards, and forwards, and may be marked out by a line drawn from midway between the borders of the axilla, to the middle point between the condyles of the humerus; so that in the first part of its course, the vessel is situated on the inner side of that bone, and inferiorly on its anterior aspect. Its external side is in apposition, in the upper half of the arm, with the coraco-brachialis, in the lower with the biceps, the border of which muscles somewhat overlaps it."

What is the most frequent cause of this artery being wounded?

1054. A want of care in the operation of phlebotomy.

What treatment would you adopt in such a case?

1055. The lips of the wound having been accurately closed by a small strip of adhesive plaister, a graduated linen compress is to be laid over the puncture, which may be confined in its proper situation by strips of the same kind of plaister long enough to encompass the arm. After this a calico roller is to be carried around the extremity, with a moderate degree of tightness, from the axilla to the palm of the hand.

Should you deem it necessary, from its having been wounded from any cause, to tie this vessel, at what part of its course might this operation be best effected?

1056. This ought to be done in the wound itself, if sufficiently capacious, or the wound may be dilated for that purpose, as the vessel may be exposed and tied in any part of its course.

Is there any guide for your finding the brachial artery?

1057. Yes; the border of the biceps and coraco-brachialis muscles.

State the method of cutting down upon and tying this vessel.

1058. The arm being drawn away from the side, slightly everted, and the hand being supinated, let the first incision through the skin be made about two inches in length along the border of the biceps muscle. "This will expose the fascia, which is to be divided to the same extent. If the operation be performed low down, the median nerve will be found to the inner side of the artery; if in the middle, it lies in front of the vessel, or crosses immediately behind it; whilst in the upper part of the arm the nerve lies to the outer side of the artery. These facts should be remembered, when the endeavour is being made to separate the nerve from the artery, preparatory to passing the ligature round the latter. If the fore-arm is a little bent, the biceps muscle and the nerves become relaxed, and may readily be drawn aside, so as to facilitate the separation of the artery from the veins which accompany it, previously to passing the ligature round it."—*Dr. Quain.**

ORDER 3.—*Cubitalia.* Emergencies occurring to the fore-arm.

GENUS 1.—*Dislocatio.* Dislocation.

What bones enter into the formation of the elbow-joint?

1059. The humerus, radius, and ulna.

What are the ligaments which connect these bones?

1060. There are four ligaments which connect this joint; viz. an anterior and a posterior, an external and an internal lateral ligament; and all these are lined by synovial membrane.

There is also a coronary or annular ligament, which embraces the neck of the radius, confining the head of that bone to the lesser sigmoid cavity of the ulna. This is lined with synovial membrane; and, lastly, there is the oblique ligament, which arises from below the coronoid process of the ulna, and stretches across obliquely to just below the tubercle of the radius.

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* In performing venesection at the bend of the arm, the median cephalic ought, if sufficiently developed, to be selected for the puncture, not only because it generally lies externally to the brachial artery, but because it usually yields a good stream. But whatever vein we may be called upon to

By what muscles is the elbow-joint supported?

1061. Anteriorly by the brachialis internus and tendon of the biceps, posteriorly by the anconeus and triceps, externally by the extensors, and internally by the flexors of the wrist.

State the various dislocations which may occur to the elbow-joint.

1062. Both bones may be luxated backwards, or thrown off the condyles laterally. The ulna may be displaced separately from the radius The radius may be dislocated backwards separately from the ulna; but the radius alone can be dislocated forwards.—*Vide Sir A. Cooper's Treatise on Dislocations.*

SPECIES I.—*Dislocatio simplex.* Simple dislocation.

VAR. I.—*Dislocatio radii et ulnæ posterior.* Displacement of both bones backwards.

What are the diagnostic marks of this dislocation?

1063. "The shape of the elbow is altered, as there is considerable projection posteriorly, formed by the ulna and radius, above the natural situation of the olecranon. On each side of the olecranon appears a hollow. A considerable hard swelling is felt at the fore part of the joint, immediately behind the tendon of the biceps muscle, formed by the extremity of the humerus. The hand and fore-arm are supine, and cannot be rendered entirely prone. The flexion of the joint is also in a great degree lost."—*Sir A. Cooper's Treatise, &c.*

In what manner ought this luxation to be reduced?

1064. "The patient is made to sit down upon a chair, and the surgeon, placing his knee on the inner side of the elbow-joint in the bend of the arm, and taking hold of the patient's wrist, bends the arm At the same time he presses on the radius and ulna with his knee, so as to separate them from the

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select, it is our bounden duty, *previously to the application of the ligature,* to ascertain the precise position of the artery, and if it be found to lie immediately under the vein we have selected to puncture, we should go to another; if there be found no substitute, and we are constrained to open the vein that lies over the artery, we shall be enabled to prevent all danger of wounding the latter, by holding the lancet between the fore finger and thumb so close to the point that there shall not be depth of blade enough to transpierce the vein, but enough to penetrate its cavity and rip it open. The wounding of the brachial artery in bleeding *can always be avoided* by common care and attention, and therefore its occurrence is without excuse.

os humeri, and thus the coronoid process is thrown from the posterior fossa of the humerus: whilst this pressure is supported by the knee, the arm is to be forcibly, but slowly, bent, and the reduction is soon effected."—*Ibid.*

Var. 2.—*Dislocatio radii et ulnæ lateralis.* Lateral displacement of both bones.

State the appearances of the joint in the lateral dislocations of the elbow.

1065. " In this case, the ulna, instead of being thrown into the posterior fossa of the os humeri, has its coronoid process situated on the back part of the external condyle of the humerus. The projection of the ulna backwards is greater in this than in the former dislocation, and the radius forms a protuberance behind and on the outer side of the os humeri, so as to produce a hollow above it. The rotation of the head of the radius is distinctly felt by rolling the hand. Sometimes the ulna is thrown upon the internal condyle of the os humeri, so as to produce an apparent hollow above it. The rotation of the radius is distinctly felt by rolling the hand. Sometimes the ulna is thrown upon the internal condyle of the os humeri, but it still projects posteriorly, as in the external dislocation; and then the head of the radius is placed in the posterior fossa of the humerus. The external condyle of the os humeri, in this case, projects very much outwards."—*Ibid.*

State the best modes of reducing lateral luxations of the elbow.

1066. " The reduction of each may be effected, as in the former dislocation, by bending the arm over the knee, even without particularly attending to the direction of it inwards or outwards; for as soon as the radius and ulna are separated from the os humeri by the pressure of the knee, the muscles give them the proper direction for reduction. In recent injuries of this kind, Sir Astley Cooper advises the arm to be extended, which will call the action of the biceps and brachialis to our aid, and immediately reduce the luxation."—*Ibid.*

Var. 3.—*Dislocatio ulnæ posterior.* Displacement of the ulna backwards.

What are the symptoms of this accident?

1067. "The appearance of the limb is then much deformed by the contortion inwards of the fore-arm and hand. The olecranon projects, and can be felt behind the os humeri. Extension of the arm is impracticable but by a force which will reduce the dislocation, and it cannot be bent to more than a right angle. It is an accident somewhat difficult to detect: but its distinguishing marks are the projection of the ulna, and the twist of the fore-arm inwards."—*Ibid.*

In what manner is this kind of displacement to be reduced?

1068. "This dislocation is more easily reduced than that of both bones; and the best method is to bend the arm over the knee, and to draw the fore-arm downwards. The reduction will then be easy, as not only the brachialis muscle will act in assistance, but the radius, resting against the external condyle, will push the os humeri backwards upon the ulna, when the arm is bent."—*Ibid.*

VAR. 4.—*Dislocatio radii anterior.* Dislocation of the radius forwards.

Describe the appearance of this accident.

1069. "The fore-arm is slightly bent, but cannot be brought to a right angle with the upper, nor can it be completely extended. When it is suddenly bent, the head of the radius strikes against the fore part of the os humeri, and produces so sudden a stop to its motion, as at once to convince the surgeon that one bone strikes against another. The hand is placed in a prone position; but neither its pronation nor supination can be completely performed, although its pronation be nearly complete. If the thumb be carried into the fore and upper part of the elbow-joint, the head of the radius may be felt there; and if rotation of the hand be attempted, the bone will be perceived to roll. This last circumstance, and the sudden stop to the bending of the arm, are the best diagnostic marks of the injury."—*Ibid.*

What ligaments are ruptured in this injury?

1070. The coronary, the oblique, the anterior part of the capsular, and a portion of the interosseous ligaments.

What is the most successful mode of treating this displacement?

1071. Extension *from the hand only*, as this will act on the radius to the exclusion of the ulna from the force used, and thus reduce the displacement. "It is also right," says Sir A. Cooper, "in making the extension, to render the hand supine; as this position draws the head of the radius from the upper part of the coronoid process of the ulna, upon which it would otherwise be directed; and then to draw the fore arm by pulling the hand, and by fixing the os humeri."

VAR. 5.—*Dislocatio radii posterior.* Dislocation of the radius backwards.

Describe the appearance of this displacement.

1072. "This accident is not of frequent occurrence. The head of the radius is thrown behind the external condyle of the os humeri, or rather to the outer side of the lower extremity of that bone; and when the arm is extended, the head of the radius can be seen as well as felt behind the external condyle of the humerus."—*Sir A. Cooper's Treatise on Dislocations, &c.*

In what manner ought this displacement to be reduced?

1073. "The reduction will easily be effected by bending the arm, as in other dislocations of this joint. To secure the bone from subsequent displacement, the arm must be kept steadily bent at right angles, and secured by splints and a circular bandage in that situation, until the union of the coronary ligament has been effected, which will require the lapse of three or four weeks from the accident."—*Ibid.*

SPECIES II.—*Dislocatio composita.* Compound dislocation of the elbow-joint.

What is signified by a compound dislocation of the elbow-joint?

1074. A compound dislocation of the elbow-joint is signified, when, along with a displacement of either of its bones, there is an external wound communicating with the bone dislocated, and through which the displaced bone or bones not unfrequently are protruded.

What is the treatment of compound dislocations at the elbow-joint?

1075. In compound dislocations of this kind, the bones are to be reduced in the manner recommended for simple dislocations. This being done, the wound is to be closed with adhesive plaister, and the bones retained in their normal position by splints, and the application of a roller. "The patient must be then laid recumbent, with the elbow resting on a pillow," and the joint kept constantly moist and cool by evaporating lotion. Should there be much tumefaction of the parts, accompanied with pain, general and local bleeding will be required.

Is the lower end of the humerus liable to compound luxation?

1076. Sir A. Cooper gives a case of this kind in his Treatise on Dislocations, (p. 422.) "The condyles of the humerus were thrown inwards through the skin, the articulating surface, receiving the sigmoid cavity of the ulna, being completely exposed to view. The ulna was dislocated backwards, and the radius outwards. The lateral and capsular ligaments were torn asunder, with extensive laceration of the parts about the joint, but the artery and nerve remained perfectly free from injury." The luxation was reduced, by the assistance of Mr. Key, in the following manner:—"The humerus, being firmly grasped above its condyles, making that part a fixed point, we gradually extended the fore-arm from the position in which it was found (at right angles), and the parts returned to their relative position; but upon slightly moving the fore-arm they became displaced as before; but the reduction was effected a second time as above described." The arm was then placed in the semiflexed position, and retained *in situ* by the usual means.

GENUS II.—*Fractura.* Fracture.

SPECIES I.—*Fractura simplex.* Simple fracture.

VAR. 1.—*Fractura articulationis.* Fracture of the elbow-joint.

What are the fractures commonly met with at the elbow-joint?

1077. Fracture of the humerus immediately above the condyles; fracture of the condyles themselves; of the internal condyle; of the coronoid process of the ulna, and of the olecranon.

What are the diagnostic signs of a fracture of the humerus just above or through the condyles?

1078. "The appearances of this accident are like those of dislocation of the radius and ulna backwards; and the mode of distinguishing the two injuries is by the removal of all the marks of dislocation on extension, and by their return as soon as the extension is discontinued. In general, also, these accidents are detected by rolling the fore-arm upon the humerus, when a crepitus may be felt just above the elbow-joint."—*Sir A. Cooper's Treatise, &c.*

What is the treatment of this fracture?

1079. "Its treatment consists in bending the arm and drawing it forwards to effect replacement; then a roller should be applied while it is in the bent position. The best splint for it is one formed at right angles, of which the upper portion should be placed behind the upper arm, and the lower portion under the fore-arm. A splint must also be placed upon the fore part of the upper arm, and both should be confined by straps. Evaporating lotion should be used, and the arm kept in the bent position by a sling."—*Ibid.*

By what symptoms can fracture of the internal condyle of the humerus be distinguished?

1080. "First, The ulna appears dislocated from it and from the broken condyle, projecting behind the humerus when the arm is extended.

"Secondly, The ulna resumes its natural situation in bending the arm.

"Thirdly, by grasping the condyles, and bending and extending the arm, a crepitus is perceived at the internal condyle.

"Fourthly, When the arm is extended, the lower end of the os humeri advances upon the ulna, so as to be felt upon the anterior part of the joint."—*Ibid.*

How would you treat an accident of this kind?

1081. "Its treatment consists in applying a roller round the elbow-joint, to keep the bone in complete apposition; in wetting it frequently with spirits of wine and water; and in bending the limb at a right angle, and supporting it in a sling."—*Ibid.*

What are the distinguishing marks of fracture of the external condyle?

1082. This accident is readily detected by the following symptoms:—"Swelling upon the external condyle, and pain upon pressure. The motions of the elbow-joint, both of extension and flexion, are performed with pain. But the principal diagnostic sign is a crepitus produced by the rotatory motion of the hand and radius. If the portion of the fractured condyle be large, it is drawn a little backwards, and carries the radius with it; but if the portion be small, this circumstance does not occur."—*Ibid.*

State the mode of treating this fracture.

1083. "A roller is applied around the elbow, and above and below the joint. An angular splint is to be adapted, which should admit the elbow, extend behind the upper arm, and receive the fore-arm, so as to support it. A roller should then be bound over the whole, to keep it firmly fixed. In the child this splint may be made of stiff pasteboard, bent to the shape of the elbow; but the best mode for its application is, to dip it in hot-water, and apply it wet, so that it may exactly adapt itself to the form of the limb."—*Ibid.*

Are there any diagnostic appearances which can enable you to discover a fracture of the coronoid process of the ulna?

1084. The diagnosis is by no means easy. By grasping the joint, and placing the thumb over the coronoid process, whilst the fore-arm is bent upon the humerus, it may be possible to detect a crepitus. The ulna is projected considerably backwards, when the arm is extended, and returns into its natural position, when the arm is bent. The latter circumstance affords strong proof that the coronoid process is fractured, and separated from the sigmoid cavity of the ulna.

Can any treatment be successfully adopted in this case?

1085. "Ossific union hardly ever takes place. It will be right, however, to keep the arm steadily in the bent position for three weeks after the injury, and thus to make the ligamentous union as short as possible, by leaving the bone perfectly at rest."—*Sir A. Cooper's Treatise, &c.*

By what signs can fracture of the olecranon be discovered?

1086. "The injury is readily recognized: there is inability to extend the fore-arm by its own muscular power, a considerable space is felt between the separated portions of the bone, and the upper fragment is moveable as well as detached. These marks of the injury are rendered more conspicuous by bending the joint. Crepitation is produced by moving the limb when extended, and the separated parts thereby approximated. Bloody swelling soon takes place, large and extensive when bruising of the soft parts has been great; and this is usually the case, in consequence of the injury being almost always the result of direct violence. In some cases the process is comminuted."—*Liston's Elements of Surgery.*

What steps ought to be taken with the view of uniting the fracture by ossific matter?

1087. Having reduced the tumefaction immediately consequent upon the injury, by means of leeches and cold lotions, a bandage is to be applied; and in those cases, where but little swelling has been produced, the limb should be secured by a bandage at once. "The principle of treatment is to preserve the power of the limb, by making the separation of the bones as slight as possible; and, secondly, to restore the natural motions of the joint. If the swelling and inflammation do not prevent it, the surgeon is to place the arm in a *straight* position, and to press down the upper portion of the fractured olecranon until he brings it in contact with the ulna. A piece of linen is then laid longitudinally on each side of the joint, a wetted roller is applied above the elbow, and another below it. The extremities of the linen are then to be doubled down over the rollers, and tightly tied, so as to cause an approximation. Thus the bones are brought and held together. A splint well padded is to be applied upon the fore part of the arm, to preserve it in a straight position, and is to be confined to it by a circular bandage. The whole is to be frequently wetted by spirits of wine and water."—*Sir A. Cooper's Treatise, &c.*

Suppose the fracture to have occurred an inch from the point of the elbow, what treatment ought then to be adopted?

1088. The same as for a fracture of the olecranon.

State what fractures of the elbow-joint require the bent, and what the straight position of the arm.

1089. "All fractures of the elbow-joint require the bent position, except the fracture of the olecranon, which requires the straight position of the arm."—*Ibid.*

Var. 2.—*Fractura columnæ radii et ulnæ.* Fracture of the shaft of the radius and ulna.

At what points are these bones most commonly fractured?

1090. "The radius may be broken at the upper part near its head, and at its middle, but most frequently near the distal extremity."—*Liston's Elements.*

"The ulna is usually broken by force directly applied, as when the arm is brought in contact with hard bodies in falls. By direct violence also both bones may give way about the middle, and at corresponding points; or, when force is applied in the direction of the bones, the ulna may be found broken near the wrist, and the radius near the elbow."—*Ibid.*

By what signs might fracture of either or both of these bones be detected?

1091. "The existence of fracture is ascertained by tracing the bones with the fingers, and by gently rotating the limb; the broken portions moving on each other produce distinct crepitation. When the radius is broken near its centre, the fore-arm is kept pronated, and the broken extremities are drawn towards the ulna: by bringing the limb towards the supine position, the ends come together, and the one bone is removed from the other. Fracture of the radius, near the distal extremity, produces displacement of the wrist, with great deformity; and this is increased by bloody effusion into the sheaths of the tendons, and into the superficial cellular tissue. In fracture of both bones, there is much deformity and shortening of the limb; the power of moving the hand is lost, the muscles are bruised and torn, and great swelling soon results."—*Ibid.*

What is the treatment of fracture of the shaft of either of these bones?

1092. When either of them is fractured near its head or at its middle, no difficulty will be experienced in retaining the broken ends in a natural position; but when either, especially the radius, is fractured at its distal extremity, the task is not accomplished so readily. Having reduced the fracture by an adequate extension, and the fore-arm brought to semi-pronation, the broken ends of the bone are to be kept in proper position by two splints, long enough to extend from the condyles of the humerus to the fingers. If the splints, that are applied, be shorter than this, the fracture will not be controlled, and deformity will be the result.

State the treatment to be adopted when both bones are broken.

1093. "When both have given way, slight extension is required, and the fore-arm is placed in the middle state between pronation and supination. Two pasteboard splints, softened in hot water, and padded with tow, are applied one on each aspect, from a little above the elbow to over the fingers; the outer should extend to the tops of the fingers, the inner need not pass the palm; they are retained by a roller."—*Liston's Elements.*

If pasteboard splints be inadequate to keep the bones in position, wooden ones must be substituted.

SPECIES 2.—*Fractura composita.* Compound fracture.

VAR. 1.—*Fractura articulationis composita.* Compound fracture of the elbow-joint.

What would be your treatment of a compound fracture of the elbow-joint?

1094. The treatment must of course depend on the circumstances attending the fracture, but in the majority of cases we may attempt to save the limb. Having removed all loose portions of bone, and cleansed the wound of any extraneous matter that may have found its way into it, its edges must be accurately brought together and kept in apposition "by placing a piece of lint, dipped in blood, over them, supported by adhesive plaister, and a bandage lightly applied, wetted with spirits of wine and water." The arm must be supported by splints, as in cases of simple fracture; and as anchylosis in a greater or less degree takes place in almost every instance of compound fracture of the elbow-joint, the arm should be kept in the bent position, as being most convenient to the patient.

What is the treatment of compound fracture of the olecranon?

1095. "In compound fractures of this bone, the edges of the skin must be brought into exact apposition; lint, embued with blood, must be applied on the wound with adhesive plaister over it, and union by adhesion must be effected if possible; but in other respects the treatment is the same as in simple fracture."—*Sir A. Cooper's Treatise, &c.*

You have stated that in the majority of cases of compound fracture of this joint, the saving of the limb may be attempted. What authority can you bring in support of this rule?

1096. Many high authorities can be given in support of it. The following will suffice:—"In the most severe accident of this kind," says Sir A. Cooper, "the constitution is generally able to support the injury, if it be judiciously treated." "We have remarked," says Mr. Hammick, "that in the compound fractures of the humerus, communicating with the elbow-joint, which have fallen under our care, no patient has been lost during the inflammatory stage, or from tetanus, and if we could not ultimately succeed in saving the limb, we have always been able to bring it to such a state, that we could amputate with as great safety as in the first moments after the accident."—*Practical Remarks on Amputation, &c.*

State those compound fractures of the elbow-joint that require primary amputation.

1097. 1st. If a large incised wound enter the joint, cut off the head of either of the bones, and extensively divide the ligaments, "it will be better to proceed at once to amputation."—*Guthrie on Gun-shot Wounds.*

2dly. "If the artery at the bend of the arm be wounded, or the joint of the wrist, or the carpal bones, be injured, in addition to the injuries of the elbow, the operation is to be performed."—*Ibid.*

3dly. " A musket-ball passing through the elbow-joint, injuring the articulating ends of the humerus, radius, and ulna, is a fair case for amputation."—*Ibid.*

4thly. " A wound from a cannon-shot, injuring the bones of the elbow-joint, demands *immediate* amputation, as the neighbouring parts are also generally much injured."—*Ibid.*

5thly. " In old people, when much injury is done, there is often not sufficient strength to support the adhesive process, and amputation should be recommended."— *Sir A. Cooper's Treatise, &c.*

Might not excision of the heads of the bones of the elbow-joint be sometimes practised with greater advantage to the patient?

1098. " In cases where the articulating surface of the condyles of the humerus is alone wounded, or the head of the radius and ulna are both destroyed, I would recommend," says Mr. Guthrie, " the operation of sawing off the ends of the bones, as proposed by Moreau and Dr. Jeffray, where due attention can be paid, in preference to cutting off the arm."

But is not this an operation of such difficulty and hazard, as to be admissible only in cases manifestly well adapted to its use?

1099. So great indeed is the difficulty and hazard of the operation of excision of the heads of bones at the elbow-joint, that, unless the surgeon feels sufficient confidence in his anatomical knowledge and surgical skill to perform it, he had always better amputate the arm at once. Besides, were the excision performed ever so adroitly, the result of such an operation would in all probability be unfavourable to the patient, and subject him at last to amputation.

VAR. 2.—*Fractura columnæ composita.* Compound fracture of the shaft of the bones.

What is the treatment of compound fracture of the fore-arm?

1100 If either or both of the bones protrude through the wound, they are to be immediately reduced; and if this be found impracticable, the surgeon must effect it by enlarging the wound; or should the ends of the fracture be spiculated, they may be removed by the saw. This step being effected, the lips of the wound are to be brought together by adhesive plaister, and the limb bandaged and supported, as in simple fracture of these bones.

In what manner ought splints to be applied in compound fractures of the fore-arm?

1101. "The splints should be laid along the flat of the arm, one on each side, and not on the edges of the radius and ulna, as is sometimes done, by which the bones have been squeezed in, and have united together at one or two places by ossific union; so that the radius being joined to the ulna, the rotation of the fore-arm could never afterwards be performed." —*Hammick's Practical Remarks, &c.*

But can compound fractures of the fore-arm be always disposed of in this way?

1102. Almost every case of compound fracture of the fore-arm will justify an attempt to preserve the limb; "for although the fore-arm is liable to more complicated injuries than the upper arm, still it is quite under our management. The two bones can be more easily got at, and pieces extracted with ease; the arteries, particularly the radial and ulnar, can be cut down upon, and except at the upper part, secured without any difficulty. The interosseal, ulnar, and radial arteries, can and ought to be fairly tied, whenever they bleed, at any sacrifice of muscular parts; and the fascia may be divided freely in every direction, as it may be found to impede the discharge of matter, or cause other inconvenience to the patient. An advantage arises also from the number of the arteries supplying the lower part of the limb; for if one be wounded, yet another, and perhaps two, remain to support and nourish the parts beneath, which, from the free communication of the palmar arches, is readily effected: mortification of the fingers, therefore, seldom or never takes place from wounds of the fore-arm."—*Guthrie on Gun-shot Wounds.*

Describe the cases of compound fracture of the fore-arm which will not admit of being left to the preservative mode of treatment.

1103. 1st. A comminuted fracture of both bones, with laceration of the muscles, arteries, and nerves, demands amputation. Such an example may be furnished by the pressure of a waggon-wheel.

2dly. Fracture of both bones by a musket-ball, with division of the arteries, is a legitimate object for the operation."—*Ibid.*

3dly. Cannon-shot seldom strike the fore-arm without doing such injury as demands amputation. If the fore-arm be carried away the operation is of course immediately necessary.

What would be your practice, where both bones are fractured, with the division of only one of the arteries?

1104. This case would not justify amputation. "The artery should be fairly tied at both extremities as soon as the injury be ascertained, and which, perhaps, may even be only suspected, from the want of pulsation at the wrist."—*Ibid.*

GEN. 3.—*Vulnus proprium cubitale.* Wound occurring to the fore-arm.

At what part of the fore-arm does the humeral artery usually terminate?

1105. At about an inch below the elbow, where it divides into the radial and ulnar arteries: it sometimes divides higher up the arm, and now and then the division takes place as high as the axilla.

Describe the course of the radial artery.

1106. The radial artery, passing over the pronator radii teres, follows the course of the radial bone through its whole extent. It descends between the supinator longus and flexor radialis, resting on the flexor longus pollicis.

At the upper part of the fore-arm it is covered by the supinator longus. In its descent it becomes more superficial, and at the under part of the fore arm it lies close upon the radius, and immediately under the skin.

What is the course of the ulnar artery?

1107. At its upper part it sinks deep behind the flexor muscles of the hand, and passes afterwards, for some way, between the flexor sublimis and profundus digitorum. Near the wrist it becomes more superficial, and runs between the tendons of the flexor carpi ulnaris and flexor digitorum profundus, to the hand.

Are there any other arteries of the fore-arm, the relative position of which the practical surgeon ought to be acquainted with?

1108. The interosseal arteries may be wounded, the situation of which the surgeon ought to know, in order to their being secured. Their position is as follows:

The posterior interossea is a branch of the ulnar artery:

it comes off at the upper end of the interosseous ligament, perforates it immediately at its origin, and ramifies on the back part of the fore arm. The interossea anterior is given off from the ulnar at nearly the same point with the posterior. It is considerably the larger of the two, but only about half the size of the ulnar from which it springs. It runs close upon the interosseous ligament.

Suppose the radial and ulnar arteries were wounded by a raking musket-shot, which lodged in the elbow-joint, what would be your treatment?

1109. " Under certain circumstances of great extent of injury, as a ball passing from the wrist to the inside of the elbow-joint, it may be necessary to amputate."—*Guthrie on Gun-shot Wounds.*

What would be your treatment of the same injury without the elbow-joint being involved?

1110. "I would recommend in most cases, in the first instance, both vessels being secured at each end by regular incisions for the purpose, and the arm only removed when gangrene was commencing."—*Ibid.*

If the muscles, composing the thick part of the arm only, be carried away by a cannon-shot, even with the division of one or more vessels, what treatment would such a case require?

1111. Mr. Guthrie thinks the operation of amputation not imperiously called for, until circumstances may arise, demanding it; such as gangrene in the part itself, the effect of contusion, or in the hand, from deficient support."

If, from whatever emergency, the amputation of the fore-arm be decided on, at what point ought the operation to be performed?

1112. If circumstances admit of a choice of situation, " there are two places of general election; one near the joint of the wrist, in the lower third; the other near the elbow in the upper third of the arm."—*Ibid.* The former of these is to be preferred, if possible.

Where ought the tourniquet to be applied?

1113. On the humerus, as near to the elbow as possible.

Describe the flap operation to be performed in the lower third of the arm.

1114. " The arm being placed in the intermediate position between pronation and supination, with the thumb, if it remain, uppermost, so that the radius and ulna are in one line, and firmly held by an assistant, a catlin (two inches longer than the usual size, if it can be procured) is to be entered close to the inner edge of the radius, and brought out perpendicularly below at the inner edge of the ulna; the knife is to be carried forwards on a parallel line with the bones for half an inch, and then cut its way out with a gentle inclination, so as to leave a semicircular flap. The catlin is to be again introduced on the outside, at the same wound, and pushed out below in the same manner, the end of the knife being brought out at the wound made by the first incision, which is easily accomplished, as the point of it passes the ulna, by turning the arm a little inwards. The two flaps are to be turned back equally to the point of entrance of the knife, where the interosseal ligament, and any muscles or tendons not cut by the incisions for the flaps, are to be divided; the bones are then to be cleared, the retractor run between them, the flaps kept back, and the two bones sawed across at the same time. The radial and ulnar arteries will be found on the inner flap, and as, by the inclined cut of the flap, they may be wounded by the edge of the knife higher than where they were absolutely divided, it is advisable to tie them high, and cut off with the scissors any long portion that may be below the ligature. The tourniquet may now be loosened or taken off, when the interosseal artery will show itself between the bones on the inside, and perhaps another on the outside. If the tendons hang long, they are to be cut off with the scissors; the wound being thoroughly cleaned with cold water, the two flaps are to be placed exactly in contact, each ligature being brought straight out, or at the corners, by a single end: some straps of adhesive plaister, a slight compress, and a few turns of a roller, retain them in their situation, and in a very short time, frequently a fortnight, the cure is accomplished." —*Guthrie on Gun-shot Wounds.*

Should you select the upper third of the fore-arm for the operation, from the necessity of the case, in what manner ought the amputation to be performed?

1115. The operation at this point should be done by the circular incision, as follows:—" The arm being placed with the thumb uppermost, an assistant must retract the integuments as much as possible, whilst the operator makes one circular incision through the integuments, which must be then fairly pulled up or separated from the fascia below for nearly an inch. The edge of the knife being inclined inwards, the muscles on the inside should be divided at one slanting cut down to the bones; the same on the outside and upper part: the bones are then to be cleared by separating the muscles from them, until it is obvious they will meet over them when sawed. The interosseal ligament is next to be divided with the catlin, and the retractor passed between the bones, by which the integuments and muscles are to be well kept back, and the bones then sawed through at once, and the stump dressed as usual."—*Ibid.*

Might not the flap operation be adopted at this point also ?

1116. Yes. "The operation may be performed nearly after the manner in which it was done lower down, save that the catlin is not used to make the semicircular flaps, but the lesser amputating knife, cutting obliquely from without inwards, until the flaps should be sufficiently large to meet with a thick cushion over the ends of the bones, when sawed off; this method also makes a good stump, but I think the other preferable for young operators, as it will better cover any defects, or avoid the appearance of irregularity on the face of the stump."—*Ibid.*

Order 4.—*Carpo-digitalia.* Emergencies occurring to the wrist and fingers, &c.

Genus 1.—*Dislocatio.* Dislocation.

Species 1.—*Dislocatio simplex.* Simple luxation.

What bones enter into the formation of the wrist-joint ?

1117. "The convex surfaces of the os scaphoides and the lunare are received into the cavity formed at the inferior extremity of the radius, while the cuneiform bone is opposed to the under surface of the inter-articular cartilage ; all of which are covered by a synovial membrane."—*B. Cooper on the Ligaments.*

Does the ulna contribute to the formation of the wrist-joint ?

1118. The ulna is excluded from the general cavity of the capsular ligament ; but it is connected to the internal part of the lower head of the radius by a joint, to allow of the rotatory motion of the latter bone.

Describe the ligaments which connect the radius and ulna to the carpal bones, and to each other.

1119. "The capsular ligament passes from the edge of the articular cavity of the radius, and from the inter-articular cartilage of the ulna, to the three first bones of the carpus, surrounding a large portion of the scaphoid and lunar bones, and but a small surface of the cuneiform."—*Sir A. Cooper's Treatise.*

The wrist is strengthened on each side by the radio-carpal ligament, extending from the styloid process of the radius to the outer edge of the scaphoid bone; and by the ulna-carpal, extending from the styloid process of the ulna to the cuneiform and orbicular bones. The radius is connected to the ulna by the interosseous, and by the sacciform ligaments.

You have spoken of an interarticular cartilage; describe it more fully.

1120. The interarticular cartilage above alluded to, is placed below the radio-ulnar joint. Its outer edge is joined to the articular cartilage of the radius, and its inner edge is united to the ulna by ligament, which is attached to a cavity betwixt its styloid process and rounded extremity."—*Ibid.*

In what ways may dislocation take place at the wrist-joint?

1121. There may be three kinds of displacement at this joint; dislocation of both bones, and of the radius or of the ulna only.

VAR. 1.—*Dislocatio radii et ulnæ e carpo.* Displacement of both bones at the wrist.

What are the appearances of a displacement of both bones?

1122. "A considerable swelling is produced by the radius and ulna on the fore part of the wrist, and a similar protuberance upon the back of the wrist by the carpus, with a depression above it; the hand is bent back, being no longer in a line with the fore-arm. In the dislocation of the radius and ulna backwards, these bones are thrown upon the posterior part of the carpus, and the carpus itself is forced under the flexor tendons, which pass behind the ligamentum carpi annulare. In either case two swellings are produced, one by the radius and ulna, the other by the carpal bones, and these swellings are diagnostic of the accident."—*Sir A. Cooper's Treatise.*

What would be your method of reduction?

1123. "The surgeon grasps the patient's hand with his right hand, supporting the fore-arm with his left, whilst an assistant places his hands around the upper arm, just above the elbow; they then pull in different directions, and the bones become easily replaced."—*Ibid.*

The bones are to be kept in their natural position by a roller made wet with cold lotion, and supported by splints placed before and behind the fore-arm, reaching from the elbow to the metacarpal bones.

Var. 2.—*Dislocatio radii e carpo.* Displacement of the radius at the wrist.

What are the diagnostic marks of a displacement of the radius at the wrist?

1124. The radius is thrown upon the fore part of the carpus, and lodged upon the scaphoid bone and os trapezium. The outer side of the hand is, in this case, twisted backwards, and the inner forwards; the extremity of the radius can be felt and seen, forming a protuberance on the fore part of the wrist. The styloid process of the radius is no longer situated opposite to the os trapezium."—*Ibid.*

What is the method of reduction in this accident?

1125. The reduction is to be effected in the same manner as was recommended in the displacement of both bones at the wrist.—*Vide* 1123.

Var. 3.—*Dislocatio ulnæ e carpo.* Displacement of the ulna at the wrist.

What are the appearances occasioned by displacement of the ulna alone?

1126. "When this accident happens, the sacciform ligament is torn through, and the bone generally projects backwards without any accompanying fracture of the radius. It rises and forms a protuberance at the back of the wrist; and although it is easily pressed down into its natural position, yet as soon as the pressure is removed, the deformity returns, as the lacerated ligament has no longer the power to retain it in its place."—*Sir A. Cooper's Treatise.*

Is there any peculiar mark as to diagnosis in this injury?

1127. As in the displacement of the radius the styloid process is removed from the line of the trapezium, so in the luxation of the ulna its styloid process is removed from the line of the metacarpal bone of the little finger.

How would you treat this accident?

1128. The luxated end of the bone is to be pressed back into its articulation with the radius; and in order to retain it there, splints are to be applied along the fore-arm against the palm and back of the hand; "the splints should be padded throughout, but upon the extremity of the ulna a compress of leather should be placed, to keep it in a line with the radius.

A roller should then be applied over the splints, to confine them with sufficient firmness."—*Ibid.*

VAR. 4.—*Dislocatio carpi ossium.* Dislocation of the carpal bones.

In what manner are the carpal bones connected?

1129. The eight bones of the carpus are joined to each other by short ligaments, which pass from bone to bone, allowing but a very slight degree of motion of one bone upon another; but besides this mode of articulation, there is a transverse joint between the first and second row of carpal bones, forming a complete ball and socket. The ball is produced by the rounded extremities of the os magnum and os cuneiforme; the cup by the scaphoid, lunar, and cuneiform bones. A ligament passes from one row of bones to the other, including this articulation."—*Ibid.*

Are there any other ligaments which protect the carpus, and prevent their being displaced?

1130. The carpus is further protected by the ligamentum carpi annulare, anterior and posterior, which, by binding down the tendons of the flexor and extensor muscles upon the wrist, very materially prevent the displacement of the carpal bones.

What are the dislocations of the carpal bones, most commonly met with?

1131. Displacements of the carpal bones are not of common occurrence: but they sometimes happen: for example, the navicular bone may be pushed out of its situation upon the back of the carpus, and the os magnum and cuneiform bones, from relaxation of their proper ligaments, may be in some measure forced from their natural situation.

What is the treatment of these cases?

1132. In the former case, by extension and steady pressure, the dislocated bone is to be reduced, and kept in position, by compresses made wet with cold lotions, and by long splints and roller bandage. In the latter case, adhesive plaisters and a calico bandage will answer the purpose best.

VAR. 5.—*Dislocatio ossium metacarpi.* Dislocation of the metacarpal bones.

By what ligaments are the metacarpal bones connected to the digital row of the carpal bones?

1133. The metacarpal bone of the thumb is connected to the trapezium by a strong capsular ligament, and the junction is farther strengthened by the muscles of the thumb.

The four other bones of the metacarpus are connected "by synovial membrane, and by dorsal and palmar ligaments, proceeding from the inferior extremity of the digital row, to be attached to the necks of the metacarpus."—*Bransby Cooper's Treatise on Ligaments.*

In what manner are the inferior extremities of these bones connected?

1134. "The inferior extremities of these bones are connected by transverse ligaments, which are divided into two sets of fibres—one superficial, and the other deep; the latter are the shorter, and exclusively deserve the name of inter-transverse, passing from one bone to the other, having their anterior faces crossed with four depressions, which answer to the passage of the tendons of the flexor muscles of the fingers, and to the lumbricales. The posterior surface is connected with the tendons of the interosseous muscles, and with the ligaments connecting the phalanges with the metacarpus; while the superficial fibres pass across all the metacarpal bones, excepting that of the thumb, and may be divided into dorsal and palmar transverse ligaments."—*Ibid.*

State those dislocations of the metacarpal bones that most frequently occur, and the mode of their being reduced.

1135. "The luxation of these bones from the carpus is but of rare occurrence, even with respect to the metacarpal bone of the thumb and os trapezium, notwithstanding the extent and variety of motions of which the thumb is capable; but displacement does, however, sometimes take place in the metacarpal bone of the thumb, which is thrown backwards upon the trapezium under its extensors. In this case, the capsular ligament is torn through. The means to be employed for it are merely forcible extension."—*Ibid.*

VAR. 6.—*Dislocatio phalangum manûs.* Dislocation of the phalanges of the hand.

Describe the ligamentous union of these bones with the metacarpus and with each other.

1136. "The round inferior extremity of the metacarpus is admitted into the cavity of the superior extremity of the first phalanx of the five fingers, and their joints are connected by anterior and lateral, which form capsular ligaments, and by a lining of synovial membrane."—*Ibid.*

The phalanges are joined to each other in the same manner by a capsular, anterior, and lateral ligaments, and these joints are materially strengthened by the flexor and extensor tendons of the fingers.

In what direction does dislocation of the first phalanges usually take place?

1137. "The first phalanges present a concave surface to receive the convex extremities of the metacarpal bones; and, in consequence of the rounded surfaces of these bones extending much further forwards than backwards, the first phalanx can scarcely be thrown into the palm of the hand, but is forced backwards on the metacarpal bones. This accident most frequently occurs to the thumb, and may be readily known by the deformity on the metacarpus, and by the extension of the first whilst the second phalanx is bent."—*Ibid.*

Is this displacement easy of reduction?

1138. It is by no means easily reduced, if much time has elapsed from the time of the accident without any attempt at reduction.

What is the best method of reducing this accident?

1139. The hand is to be first steeped in warm water for a considerable time, to relax the parts as much as possible; then a piece of thin wetted leather, wash-leather for instance, is to be put around the first phalanx, and as closely adapted to the thumb as possible; a portion of tape, about two yards in length, is then to be applied upon the surface of the leather, in the knot which is called by sailors the *close-hitch*, for this becomes tighter as the extension proceeds. An assistant places his middle and forefinger between the thumb and forefinger of the patient, and makes the counter-extension, whilst the surgeon, assisted by others, draws the first phalanx from the metacarpal bone, directing it a little inward, towards the palm of the hand. Extension should be supported for a considerable time, if necessary.—*Sir A. Cooper's Treatise, &c.*

But are not such efforts sometimes unsuccessful?

1140. Yes; and in the event of failure, the pulleys are to be tried in the following manner. "The leather and sailors' knot are to be applied as above, and a strong worsted tape is to be carried between the metacarpal bone of the thumb and the fore-finger; the arm is then to be bent round a bed-post, and the worsted tape fixed to it; a pulley is then to be hooked to the tape which surrounds the first phalanx, and extension is to be made: this mode is almost sure to succeed."—*Ibid.*

State the treatment of dislocations of the second phalanx.

1141. "The surgeon should grasp the back of the first phalanx with his fingers, apply his thumb upon the fore part of the dislocated phalanx, and then bend it upon the first as much as he possibly can."—*Ibid.*

SPECIES 2.—*Dislocatio composita.* Compound dislocation.

VAR. 1.—*Dislocatio articulationis carpi comp.* Compound dislocation of the wrist-joint.

What would be your treatment of a compound luxation of the wrist?

1142. Having reduced the bone or bones dislocated, according to the rules laid down for the reduction of simple luxation, the lips of the wound are to be brought together as accurately as possible, and a pledget of lint, dipped in the patient's blood, is to be laid over it. The parts are then to be retained in position by compresses, wet with evaporating lotion, and by a roller, wetted with the same, lightly applied. The arm should be supported by splints, and kept in absolute rest.

VAR. 2.—*Dislocatio ossium carpi composita.* Compound dislocation of the carpal bones.

Should you be called to a case in which one or two of the carpal bones were forced out of their natural position, and the displacement complicated with wound, what treatment would you deem necessary?

1143. In these cases, *a carpal bone or two* may be removed by dissection, and the patient may recover, with the preservation of his hand and considerable motion of his fingers.—*Sir A. Cooper's Treatise, &c.*

Having removed the bone or bones displaced, the wound is to be closed, and the parts kept in the best state of union possible, by adhesive plaister, wet compresses, &c. &c. as advised at 1142. It will be also advisable to take blood from the arm.

Should the displacement of the carpal bones be more extensive, and if there be moreover considerable injury done to the ligaments, tendons, &c. would you deem the life of the patient sufficiently safe under such treatment?

1144. No; so extensive and complicated an injury would demand primary amputation.—*Vide ibid.*

VAR. 3.—*Dislocatio ossium metacarpi composita.* Compound dislocation of the metacarpal bones.

What is the primary treatment of this injury?

1145. "These bones," says Sir A. Cooper, "are so firmly articulated with the bones of the carpus, that I have never seen them dislocated but by the bursting of a gun, or by the passage of heavy laden carriages over the hand; and in each of these cases there is generally so much injury produced, as to render amputation necessary. In the former of these accidents, a bone, and sometimes two, are capable of being removed; and if it be necessary to amputate the middle and ring finger, the fore and little finger may be brought so nicely together, and secured in such exact adhesion, as to produce little deformity."

Should you be called to a compound dislocation of the thumb, where the metacarpal bone was driven from its connexion with the trapezium, the whole mass of muscles connecting the thumb with the hand torn through, but the flexor longus pollicis and the extensor longus pollicis remained entire, would you be justified in removing the thumb?

1146. Such a case as this occurred to Mr. G. Cooper and Mr. Brodie, in which preservation of the thumb was attempted and saved; it appears to me, however, that there was considerable hazard in the attempt, from tetanus, which is very apt to follow such an injury. Had the thumb been removed, the conduct of the surgeon would have been justified by the character of the accident. The integrity of the long extensor and flexor was the only ground on which preservation could be contemplated; and the end justified the attempt.

If it be necessary from this kind of injury to remove the metacarpal bone of the thumb, and the articulating surface of the trapezium should so project as to prevent the integuments being drawn over it, what treatment would be required?

1147. The projecting surface of the trapezium ought to be sawn off, and the integuments brought together over the remaining part of that bone; or should this not be advisable from the state of the integuments, a poultice may be laid over the wound, that it may heal by granulation.—*Sir A. Cooper's Treatise.*

VAR. 4.—*Dislocatio phalangum composita.* Compound dislocation of the phalanges.

What would be your treatment of compound dislocation of the phalanges?

1148. The displacement having been reduced in the manner recommended for the simple luxation at 1141, the lips of the wound are to be brought together, retained in position by a pledget of lint dipped in blood, and supported by bandage wet with cold evaporating lotion.

But should there be much difficulty in the reduction of one of the phalanges, and the wound be large, what treatment would be required?

1149. In such case "it is best to saw off the extremity of the bone rather than bruise the parts by long continued extension: they are to be healed by adhesion; and if passive motion be begun early, a joint will soon be formed, and a very useful member remain."—*Sir A. Cooper's Treatise, &c.*

What is the treatment of compound luxation of the second phalanx?

1150. "In compound dislocations of this joint, it is best to saw off the extremity of the second phalanx, taking care not to injure the tendon which is torn through; for when the bone is removed, the ends of the tendon may be readily approximated and adapted to each other. The extremity of the tendon should be smoothed with a knife, and the part be then bound up in lint, dipped in blood, and confined by a roller." *Ibid.*

GENUS 2.—*Fractura.* Fracture.

SPECIES 1.—*Fractura simplex.* Simple fracture.

VAR. 1.—*Fractura articulationis carpi.* Fracture of the wrist-joint.

What are the diagnostic symptoms of fracture extending into the wrist-joint?

1151. This accident can be discovered by crepitation, and by tumor of the anterior face of the fore-arm immediately above the wrist, occasioned by displacement of the end of the shaft of the radius by the action of the pronator quadratus muscle, which draws it amongst the flexor tendons, where it can be distinctly felt.—*Sir A. Cooper's Treatise, &c.*

Is not this fracture frequently accompanied by dislocations of the ulna?

1152. Fractures of the lower end of the radius are not unfrequently accompanied by such: for example, simple fracture of the lower end of the radius may be associated with dislocation of the lower end of the ulna, forwards or backwards; and in either of these cases the deformity will, of course, be increased.

What is the treatment of simple fracture of the lower end of the radius, as described at 1151*?*

1153. Mr. Cline's practice was as follows: "When fracture of the radius happens just above the wrist-joint, you must be very careful in your treatment of it, to prevent the injury from leading to the permanent loss of the use of the fingers; for so soon as the injury has happened, the pronator quadratus muscle draws the fractured end of the bone obliquely across the fore arm, amidst the flexor tendons: your object, therefore, in the treatment of this accident, is to prevent the action of the pronator from producing that effect; and the mode of treatment which you are to adopt is, to make the hand by its weight to oppose the action of that muscle. For this purpose, when the bone has been placed in its right position, by drawing the hand in a line with the fore-arm, apply a roller round the fore-arm to the wrist; then a splint upon the fore and back part of the arm, to reach to the palm and back of the hand, so as to preserve it in a half supine position; and confine the splints, by means of a roller, which should reach only to the wrist. Thus the hand, being allowed to hang between the ends of the splints, draws the end of the radius, so as to maintain a constant extension upon it, opposing the action of the pronator quadratus muscle, and keeping the broken ends of the bone constantly in their place."

Might not this kind of injury be sometimes mistaken for a sprain of the wrist?

1154. Simple fractures of the end of the radius, unaccompanied with dislocation, may be, and sometimes have been, unfortunately overlooked and considered as mere sprains, the surgeon contenting himself with the application of an embrocation, or of a simple roller made wet with cold lotion; and he may be inclined to this opinion, by not being able to feel any crepitation, which is, in some instances, prevented by the upper end of the fracture being separated from the lower, by the action of the pronator quadratus. But the surgeon should remember, that an error of this sort cannot but lead to the incapacity of the hand of his patient, and to his own disgrace.

Var. 2.—*Fractura ossium carpi.* Fracture of the bones of the wrist.

Are not these bones sometimes subject to simple fracture?

1155. This is an injury of rare occurrence, and is generally occasioned by the carpus being jammed by heavy bodies, or crushed by a wheel. It may be discovered by crepitation, produced by manipulating the bones.

What mode of treatment does such an injury require?

1156. Should there be any displacement, it should be immediately reduced; local bleeding should be employed and repeated, as often as tumefaction and inflammation may require it. The wrist is to be held together by wet compresses and bandage lightly applied, and the whole arm supported by a long splint placed in a sling.

Var. 3.—*Fractura ossium metacarpi.* Fracture of the metacarpal bones.

By what method could you discover fractures of the metacarpus?

1157. "On laying hold of the distal end of the bone suspected to have given way, placing the fingers over the shaft, and attempting slight motion, distinct crepitation is perceived."—*Liston's Elements.*

What appearances are produced, when the lower or digital head of a metacarpal bone is broken off; for example, when (as it sometimes happens) this part of the metacarpal bone of the little finger is broken off by a pugilistic fight?

1158. Such an injury would give the "appearance of dislocation of the finger, as the head of the bone sinks towards the palm of the hand."—*Sir A. Cooper's Treatise.*

How ought the metacarpal fracture to be treated?

1159. "For the cure, motion of the parts must be prevented for a sufficient time, and inflammation warded off, when threatened; there is little or no displacement (except in the latter case), and, consequently, retentive apparatus can be almost wholly dispensed with."—*Liston's Elements.*

What treatment is required, where the head of a metacarpal bone is broken off, and displaced?

1160. " In the treatment of this case, a large ball is to be placed in the hand, grasped by it, and the hand bound over it by a roller; and thus the depressed extremity of the bone is raised to its natural situation."—*Sir A. Cooper's Treatise.*

VAR. 4.—*Fractura phalangum manus.* Fracture of the phalanges of the hand.

What have you to say on the character and treatment of simple fracture of the phalanges?

1161. Simple fractures of the phalanges are at once recognised by deformity, and easily treated. The fracture having been reduced, the bones are to be kept in their proper position by small splints of pasteboard, and a narrow calico roller.

SPECIES 2.—*Fractura composita.* Compound fracture.

VAR. 1.—*Fractura articulationis carpi composita.* Compound fracture of the bones of the carpal articulation.

What is signified by a compound fracture of the carpal joint?

1162. Fracture of the bones, complicated with an external wound, penetrating the capsular ligament.

What is the treatment of this injury?

1163. The primary treatment must depend on circumstances. If the joint be not fatally injured, and there be displacement of the broken bones, such displacement must be reduced without delay, the wound accurately closed, covered with lint soaked in the patient's blood, and the parts kept in proper position by adhesive plaister, wet compresses, and a bandage lightly applied. The fore-arm is then to be laid on a long splint, and the whole supported by a sling.

What would be your conduct, if the lower extremity of the radius were comminuted, and the ulna dislocated, and thrust through the skin?

1164. The ulna ought to be reduced; and if any " loose pieces of bone can be felt at the extremity of the radius, the wound should be enlarged for their removal; and instead of fomentations and poultices, a quantity of lint dipped in the patient's blood should be applied round the wrist, lightly bound with a roller. The arm should be supported upon a splint, so as to be kept perfectly free from motion; evaporating lotions should be applied, and the limb should not be disturbed, unless the patient has symptoms of a suppurative process, when a small opening should be made in the bandage, to allow of the escape of pus; but still the bandages should be suffered to remain. The patient should be bled from the arm, if the inflammation and constitutional irritation be considerable; and under these circumstances leeches should be occasionally applied. The bowels should be kept gently open, but all active purging avoided."—*Sir A. Cooper's Treatise, &c.*

What do you mean to imply by the expression, "unless the joint be fatally injured?"

1165. I allude to such injuries as require primary amputation.

Describe those injuries that require the operation?

1166. First. "If the joint of the carpus be opened, and the radius, the scaphoides, and lunare, also destroyed, the operation is generally requisite."—*Guthrie on Gun-shot Wounds, &c.*

Secondly. "If the ulna and radius be both injured in the same manner, amputation is necessary as a primary operation."—*Ibid.*

Thirdly. Primary amputation will be demanded, where the limb has been torn off at this point by a cannon-shot, machinery, &c.

VAR. 2.—*Fractura ossium carpi composita.* Compound fracture of the carpal bones.

What are the principal causes of compound fractures of these bones?

1167. The bursting of gun-barrels, the force of machinery, the crushing of heavy carriage-wheels, and gun-shot, are amongst the chief causes of this injury.

What would be your treatment of such a case?

1168. It is scarcely possible to lay down any thing like precise rules for the guidance of the surgeon, whose judgment must ever influence him, according to the peculiar circumstances of the case. It may be, however, stated, that if the fracture be not comminuted, nor involving many of the bones, and if the tendons be for the most part whole, the preservation of the limb may be justifiably attempted, and treated according to the rule laid down at 1164.

Suppose a musket-shot had wounded the metacarpal range of these bones, what would be your conduct?

1169. "Wounds by musket-shot of the lower range of bones of the carpus do not require amputation. I have seen numbers of them do well and recover with some little loss of motion of the wrist, and of the fingers to which the tendons that may be divided were going; but even this is in some measure removed in time by the connexion there is between all the flexor and extensor tendons of the hand."—*Guthrie on Gun-shot Wounds.*

What case, then, would demand the primary operation?

1170. A comminuted fracture of the carpus generally, with extensive laceration and division of the tendons, blood-vessels, &c., would undoubtedly require immediate amputation.

VAR. 3.—*Fractura ossium metacarpi composita.* Compound fracture of the metacarpal bones.

Is there any unfavourable result to which compound fractures of the metacarpal bones and lacerations of the hand are peculiarly liable?

1171. Such injuries are particularly liable to locked-jaw, and in order "to avoid this, in many instances the hand has been removed, when it might otherwise have been in part saved."—*Guthrie on Gun-shot Wounds.*

But when one or two fingers might very probably be saved, ought not a reasonable hazard to be encountered?

1172. "The advantage of two or three fingers, or even the fore-finger, is so great, that much ought to be attempted and hazarded to save them."—*Ibid.*

In your attempts to save the fingers, what means would you adopt to prevent the serious results of tetanus or trismus?

1173. Tetanus may be in some measure prevented by smoothing with a clean cutting scalpel, especially all lacerated fascial surfaces, "by freely cutting up the palmar aponeurosis, removing all spiculæ of bone, and by keeping the wound open, preventing the collection of any matter under the fascia, or expansion of the tendons." It will be also of *great importance* to keep the bowels freely open by cooling purgatives.

But in cutting up the palmar aponeurosis, will there not be great danger of wounding the subjacent arteries?

1174. The fear of wounding the arteries ought not to be indulged. It is, truly, advisable to avoid them, if possible, but this immnuity should not be acquired at the hazard of causing a greater evil; for they are secured, if injured, with tolerable ease, and if the incisions be made in the direction of the bones and flexor tendons on the inside of the hand, when they are required on that side, there will not much hæmorrhage ensue, that cannot readily be commanded by the ligature, or a small graduated compress."—*Ibid.*

What is the situation of that continuation of the ulnar artery, called the superficial palmar arch?

1175. "The arcus superficialis is placed with its convex side downwards, and extends obliquely from the root of the metacarpal bone of the little finger, towards that of the first bone of the thumb; being covered by the expansion termed aponeurosis palmaris."—*Fife's Compendium.*

State the ramifications of the superficial palmar arch, and their position.

1176. First, "Several small branches are sent off to the integuments and other superficial parts of the palm; secondly, a considerable branch, termed ulnaris profunda of the palm, which sinks near the root of the metacarpal bone of the little finger, and, inosculating with the palmar branch of the radial artery, assists in forming the arcus profundus; thirdly, a branch to the inner side of the little finger; fourthly, three large digital branches, which run opposite to the interstices of the metacarpal bones to the clefts between the fingers."—*Ibid.*

Describe the ramification and position of the radial artery on the hand.

1177. "At the under end of the fore-arm, the radial artery turns back under the tendons of the extensors of the thumb; then, getting between the roots of the metacarpal bones of the thumb and fore-finger, and perforating the abductor indicis, it divides into three principal branches, viz., the anterior magna pollicis, which runs along the side of the thumb next the fingers, and sometimes divides at its root into two branches, which supply both sides of it; the radialis indicis, which runs along the side of the fore-finger next the thumb, and the palmaris profunda, which crosses the hand between the roots of the metacarpal bones and flexors of the fingers, and forms an arcus profundus, from which branches go off to the interossei and other deep parts of the palm."—*Ibid.*

Suppose that, either from the bursting of a gun, the catch of machinery, or the force of a musket-ball, two of the metacarpal bones were broken and comminuted, what would be your treatment?

1178. It would not be "necessary to amputate as a primary operation for this cause alone, whatever cause may render it necessary afterwards; on the contrary, the wound should be enlarged, the broken pieces of bone removed, and the most vigorous antiphlogistic measures adopted."—*Guthrie on Gun-shot Wounds.*

Should the hand be struck by cannon-shot, splinters of shells, or grape-shot, what treatment would such an injury require?

1179. In this case, "amputation of one kind or other is necessary, but seldom of the whole hand;" for example, when the metacarpal bones of the three innermost fingers are destroyed, "the thumb and fore-finger are worth preserving." Again; "The little finger is occasionally to be kept when the two middle ones are sawed off, and in taking away the two innermost fingers, the next metacarpal bone is not to be removed, if it even be a little injured: the tearing up of the integuments is not of so much consequence as is believed, and in performing the operation of removing any two bones, flaps may frequently be procured partly on one side, and partly on the other, when a whole one can be obtained from neither." —*Ibid.*

What, then, would you consider a fair case of compound fracture of the metacarpal bones, for primary removal of the whole hand above the wrist?

1180. If the flexor and extensor tendons be cut across and hanging out of the wound, the joint of the wrist opened, and the skin of the hand much torn; if there be also much hæmorrhage, although the blood may not be thrown out *per saltem*, and if the bones be totally destroyed, amputation is to "be performed as soon as possible, for the sooner the wound becomes a clean incised one, the better."—*Ibid.*

Should the injury be such as to require the removal only of one or more of the metacarpal bones, at what point may the removal be effected?

1181. The bodies of the metacarpal bones may be cut across, or they may be removed at their carpal articulation, according to the circumstances of the case.

Describe the operation of cutting across the shaft of the metacarpal bones.

1182. "In the removal of the two centre metacarpal bones near their middle, two transverse incisions are to be made on the back and palm of the hand, a little nearer the fingers than where they are to be sawn through, and these incisions are to be exactly the width of the two bones; the skin is to be dissected back to the place where the bone is to be sawn, and a longitudinal incision is then to be made on each side of the two bones to be taken away, between the fingers and into the palm of the hand, so as to join the transverse cut inside. Care is now to be taken that the tendons running to the fore and little fingers are not injured, as the soft parts, belonging to the fingers to be removed, are cut through: the saw or trephine is now to be applied, and the bones cut across. The little flap, saved on the upper and under part, will cover the sawed bones, and the skin saved on the sides will leave enough to cover the bones remaining, with the help of a strap of adhesive plaister, so as to leave only a line of incision every where."—*Ibid.*

Is not the metacarpal saw a defective instrument for the dividing of these bones?

1183. Yes; and so are saws of any kind; as testified by Mr. Guthrie, and the best military surgeons. They are now superseded by the cutting pliers, an instrument much better adapted for this purpose.

How ought this instrument to be used?

1184. "It is applied perpendicularly, and should always have its smooth surface in contact with the part to be retained, otherwise the cut part will be rough and irregular." —*Liston's Elements.*

As it must be manifest, from the wound inflicted on the hand, that the flaps cannot always be formed as you have described, in what manner would you substitute other coverings?

1185. In the majority of cases certainly, where the hand has been perforated, the integuments may be so lacerated as not to allow of the general rule being followed; and therefore the flap "must be kept either from the back part or inside, as may be most convenient, which in almost every case of the hand will somewhat vary the first incision."—*Guthrie on Gun-shot Wounds.*

In what manner would you remove one of the middle metacarpal bones?

1186. The operation of removing a single bone will be the same as that for removing two, as described at 1182; but this will require more care, lest the articulation of the adjacent fingers be injured.—*Ibid.*

If there were no wound through the hand, what difference ought to be observed in the mode of operating?

1187. "The knife is entered over the dorsal centre of the bone above the (injured) part, and carried straight downwards till near the articulation, when it is made to diverge for the formation of lateral flaps: the integuments in the track of the longitudinal wound are then dissected backwards, so as to expose the bone completely, and the bistoury is passed round the bone throughout its whole extent, the edge being kept close to it, in order that the soft parts may be separated, and that without any unnecessary width of wound. Then the bone is clipped at the upper point with the cutting pliers; or the section of the bone may be performed before separation of the soft parts from its under surface, as by raising the cut end, this part of the operation may be facilitated."—*Liston's Elements.*

In what manner ought amputation of the metacarpal bones of the middle and ring fingers to be performed at the carpal articulation?

1188. "If the articulating heads must come out, a strong but thin scalpel is to be used, and pushed in between the bones, the ligaments being cut clean above, below, and at the sides: care should be taken, in the efforts to get out the heads of these bones, not to dislocate the other fingers, or to injure them as little as possible; and the cavity of the joint of the carpus should be covered by a flap or flaps, if they can be obtained."—*Guthrie on Gun-shot Wounds.*

If along with the base of the metacarpal bones some of the second row of the carpal bones should be destroyed, and the injury be such as in your opinion to require amputation, might not the hand be removed at the wrist-joint?

1189. Yes; and in the following manner:—The tourniquet having been applied on the upper arm, and "the patient being seated in a chair, the surgeon first makes a circular incision with a catlin through the integuments, just over the bases of the metacarpal bones, which should include more of the integument upon the back of the hand than towards the palm; he then dissects the skin back as far as the styloid process of the radius: the integument is held back by an assistant, whilst the surgeon takes hold of the hand he is about to remove; and feeling for the extremity of the styloid process of the radius, he passes the catlin into the joint between the radius and scaphoid bone, by dividing the external lateral ligament; and he completes the amputation by carrying the knife through to the inner side of the carpal joint. It will be necessary, before dressing the stump, to secure the ulnar and radial arteries by ligatures."—*Sir A. Cooper's Lectures, by Tyrrell.*

Describe the mode of amputating the thumb at the carpal joint.

1190. "The first phalanx of the thumb requiring to be removed, an incision must be made on the back of the hand on the inside of the bone, commencing between the thumb and the finger, carried down to the joint of the carpus, and brought over with a gentle slope to the outside. A similar incision in the palm of the hand joins the point of this slope, and the muscles are to be divided close to the bone. The flap over the joint of the thumb, formed by the slope of the integuments, is to be pulled a little back, the external lateral ligament cut into, and the thumb bent and pressed a little inward, when it will readily be separated by cutting through the capsular ligament, and any adherent ligamentous or muscular fibres. The compression of the brachial artery is to be taken off, the vessels tied with single threads, and the parts brought together with adhesive strap and bandage."—*Guthrie on Gunshot Wounds.*

In what manner would you amputate the metacarpal bones of the fore and little fingers at their carpal extremities?

1191. "The outer fingers are easily removed at the joint, commencing from the outside, and when the ligaments on the inside are cut, dislocating them outwards."—*Ibid.*

Is it not advisable to amputate through the metacarpal bones, rather than remove them at their carpal joint?

1192. "The preserving the articulation inviolate especially supports the remaining fingers, and leaving a part of the metacarpal bone of the fore-finger is of great utility in giving strength and freer motion to the thumb."—*Ibid.*

VAR. 4.—*Fractura phalangum composita.* Compound fracture of the phalanges.

What are the usual local results of a severe compound fracture of the phalanges, if an attempt be made to preserve the finger?

1193. "Compound fractures of the phalanges are almost uniformly followed by most violent inflammatory action in all the tissues, terminating in disease of the joints, and in the death of the tendinous and fibrous tissues. The suppuration is profuse and unhealthy, and the infiltration of the soft parts extensive. The diseased action not unfrequently pervades the palm of the hand. In the great majority of cases, necessity for amputation arises sooner or later."—*Liston's Elements.*

But as every case of compound fracture might not require removal of the finger, will you briefly distinguish between those that *would justify an attempt to preserve, and those that would render it necessary to amputate the finger?*

1194. If the bone protrude through the integuments at the back of the finger, without comminution, implication of the joint, or laceration of the flexor tendons, the preservative treatment is justifiable; but if there be comminution of the bone, laceration of the flexor tendons, or implication of the joint, primary amputation is required.

At what point of the phalanx ought the operation to be performed?

1195. "It is generally best to remove these bones at the joints; it is occasionally necessary, where the injury just includes the joint and no more, to saw them off below."—*Guthrie on Gun-shot Wounds.*

What is the best mode of removing the first phalanx at the metacarpal joint?

1196. A flap, if practicable, should be made from the back of the finger. With this view the joint is first to be ascertained; and "from this point an incision is to be made along each side of the finger for about half an inch, in a semi-lunar form, and the angle of these two joined by a transverse incision underneath, where a flap can be raised of sufficient size to cover the wound when the bone is removed. The flap being turned back, the extensor tendon divided, and the joint laid bare, a half semi-circular incision is to be made on the under part, so as to divide every thing down to the bone. The joint should now be a little bent, to shew its exact position; the ligamentous attachment between the bones, on each side connecting it to its fellow, cut through; and the lateral ligament divided, when the joint will be easily dislocated. Two small vessels will often require a single thread; sometimes even a pinch from the forceps will be sufficient to stop the hemorrhage."—*Ibid.*

The flap is to be laid over the bone, and retained *in situ* by adhesive plaister. Should it be impracticable to take the flap from the back of the finger, it may be taken from beneath, or flaps may be formed on the sides of the phalanx by an elliptical incision, carried from the back to the front of the joint.

Is not another mode of operating preferred by some eminent surgeons?

1197. Sir A. Cooper adopts the following method. "When it is necessary to remove the whole of a finger, I think it better to saw off the extremity of the metacarpal bone, rather than to open the joint. If the middle or ring-finger be thus removed, less deformity results from the operation, as the remaining fingers approximate much more than when the extremity of the metacarpal bone is left: if the fore or little fingers are amputated in this manner, an ugly projection is prevented, which would not be of any utility if suffered to remain."

Describe the operation.

1198. " The finger to be amputated being extended and separated from the others, two incisions are to be made through the integuments, which meet at an angle over the dorsum of the metacarpal bone, at a short distance below the digital extremity, and terminate on each side of the first phalanx at the natural separation of the fingers; two other incisions, of the same form and extent, are to be made on the palmar side, which are to join the former between the fingers; the scalpel is then to be passed down on each side of the extremity of the metacarpal bone, so as to divide it completely from its lateral connexions, and the extensor and flexor tendons are also to be cut through at the point of the first incisions; this being accomplished, the blade of the metacarpal saw" (or the cutting pliers) " is to be introduced between the bones, and the extremity to be removed is to be carefully sawn" (or cut) " off."—*Lectures of Sir A. Cooper, by Tyrrell.*

State the method of removing either the fore or little fingers, according to this practice.

1199. " In amputating either the fore or little finger, only two external incisions are required, which should begin at a point below the extremity of the metacarpal bone, as in the other case, only over the centre of that side which is outermost, and extend one over the joint and the other under it in an oblique direction, so as to meet between the fingers; two flaps are then to be raised, so as to expose the extremity of the metacarpal bone, the separation of which is to be completed as before described."—*Ibid.* The vessels are to be secured by pressure or ligature.

What is the best method of amputating the phalanges at their penultimate joints?

1200. " The finger being extended, the integument is cut through by a circular incision about half an inch beyond the joint, and a lateral incision is to be made on each side, in the direction of the lateral ligaments, extending from over the joint to the circular cut; the portions of integument are to be raised from the flexor and extensor tendons, below and above, as far as the joint, making two flaps; after which, the tendons and one of the lateral ligaments are to be divided, when the joint may be easily dislocated, and separation of the part readily accomplished."—*Ibid.*

But is it practicable always to accomplish the operation in this way?

1201. External injuries will seldom allow us to act according to set rules. We may have to form the flap from the back, side, or front of the finger, as may best answer the purpose of covering the stump.

What is the most expeditious mode of amputating the ultimate joint of the phalanx?

1202. The following method of Sir A. Cooper's will be the most expeditious and the best:—

A single flap is to be made from the palmar part. "In doing this, the joint must be flexed, when the scalpel is carried through the integuments on the dorsum of the joint, and through the joint itself, dividing the ligaments at one cut; the knife is then passed under the phalanx, which is to be amputated, and a flap of sufficient extent is separated from the palmar side."

Should the fracture be confined to the joint itself, would you remove the finger at the next joint, or divide the body of the bone close to the injured articulation?

1203. The phalanx should be removed at the latter point, and by the method recommended at 1200.

By what means would you check the bleeding of the digital arteries after the operation?

1204. A ligature will seldom be necessary. The pressure from the dressings will usually suffice.

Class X.—*Cruralia.*—Emergencies occurring to the lower extremities.

Order I.—*Femoralia.* Femoral.

Genus 1.—*Dislocatio.* Dislocation.

Species.—*Dislocatio femoris.* Luxation of the femur.

By what bones is the articulation of the hip constructed?

1205. By the head of the femur and the cotyloid cavity of the os innominatum, forming a complete ball and-socket articulation.

Is there not a difference, in respect to the depth of its cavity, between this socket as seen in the skeleton, and that as seen in the recent subject?

1206. "In a recent state we find it much more capacious than in a dried bone, from the addition of a fibro-ligamentous substance, investing its circumference;" by the assistance of which it completely surrounds the head of the femur.—*B. Cooper's Treatise on Ligaments.*

What are the ligaments which unite this articulation?

1207. The capsular, the round, and the cotyloid ligaments.

Give a brief description of the capsular ligament.

1208. "This ligament, which is the strongest and thickest in the body, surrounds the whole of the joint. It begins to arise from the circumference of the acetabulum, and proceeds in a direction outwards and backwards, to be attached to the base of the neck of the femur, extending outwards to the pit of the trochanter major, and downwards to the trochanter minor; in the intermediate space it is connected by the linea quadrata." "Its thickness is very considerable, particularly before and above, where it is strengthened by an accessory ligament, which passes from the anterior and inferior spine of the ilium to the fore part of the capsular ligament, to which it is firmly united. On the inner side the fibres of this ligament are often so much separated as to leave a space between them, exposing the synovial membrane; and then it is again strengthened by fibres, which pass downwards from the obturator foramen. The whole external face of the capsular ligament of this joint is covered by the insertion of muscles destined for the motion of the thigh-bone; its internal surface is lined by synovial membrane."—*Bransby Cooper's Treatise.*

State the anatomy and connexions of the ligamentum teres.

1209. "This is composed of ligamentous fibres, which pass from the inner and fore part of the cotyloid cavity to a rough fossa on the head of the femur. Its form is that of a triangle, the apex of which is attached to the thigh-bone, and its base, which is bifurcated, forms two flattened bands, which pass around the circumference of the foramen produced by the cotyloid ligament, passing over the notch of the acetabulum. —*Ibid.*

What is the nature and situation of the cotyloid ligament?

1210. "The circumference of the cotyloid cavity is surrounded by this fibro-ligamentous substance, which renders it perfectly regular, and forms into a foramen the notch, which is situated in the under and fore part of that cavity, leaving a space for the passage of blood-vessels to the ligamentum teres. It is connected with the bony edge of the acetabulum by a comparatively broad base, whilst its apex is a free border, a little inclined inwards."—*Ibid.*

In what directions may the head of the femur be dislocated?

1211. It may be luxated upon the dorsum ilii, into the ischiatic notch, upon the pubes, and into the foramen ovale.

VAR. 1.—*Dislocatio super dorsum ilii.* Luxation upon the dorsum ilii.

What are the diagnostic signs of the dislocation upwards upon the dorsum ilii?

1212. The most prominent characteristics are, "the great degree of shortening of the limb, its rotation inwards, so as to bring the trochanter major much nearer to the anterior superior spinous process of the ilium; the foot on the injured side rests upon the tarsus of the opposite one, and the knee is partly flexed, and in advance of the other. The roundness of the hip is lost, in consequence of the ascent of the head of the thigh-bone upon the dorsum of the ilium, and the consequent relaxation of the glutæi muscles."—*Bransby Cooper's Treatise on Ligaments.*

Are there any injuries with which this luxation may be confounded?

1213. The injuries with which this dislocation may be confounded, are displacement of the head of the femur upon the ischiatic notch, and fracture of the neck of the bone.

What is the diagnosis between this luxation and that into the ischiatic notch?

1214. It may be distinguished from this by the greater degree of shortening, which is such as to cause the toe of the injured side to cross the tarsus of the opposite foot; while in dislocation into the ischiatic notch, the toe on the dislocated side is only directed to the ball of the great toe on the other. —*Ibid.*

In what way may this kind of luxation be distinguished from fracture of the neck of the femur?

1215. "From fracture of the cervix femoris, it is easily distinguishable, if but common attention be paid, for there is nothing similar in the two accidents, excepting the shortening of the limb; and the fixed position of the joint in dislocation, and its moveable state in fracture, will at once preclude the possibility of mistaking one injury for the other."—*Ibid.*

Besides, in fracture of the neck of the bone, the foot is commonly turned outward, and can, with slight exertion, be brought down to a level with the other, when, by rotating the limb, a crepitation will be felt at the fractured portion. On the extension being discontinued, the shortening wiil immediately recur.

What is the treatment of this dislocation, immediately after the occurrence of the accident?

1216. " Within a very short time after the occurrence of the injury, before the patient had recovered from the shock, whilst he still lay sick, faint, and powerless, I have succeeded in effecting reduction of the femur quite unassisted, extending with one hand, grasping the thigh behind, and at the same time rotating it outwards by pressure of the fore-arm on the leg, counter-extension being made by the left hand on the symphysis pubis."—*Liston's Elements.*

Should you not arrive till a few hours after the accident, what method of reduction will then be required?

1217. The assistance of the pulleys will then be necessary, and ought to be used in preference to any other method, as being the most expeditious mode of reduction.

What treatment is usually employed previously to their application, and how are they used?

1218. " Let the patient lose from 12 to 20 ounces of blood, or even more, if he be a very strong man; then place him in a warm bath at the heat of 100 degrees, and gradually increase it to 110 degrees, until he feels faint. During the time he is in the warm bath, give him a grain of tartarized antimony every ten minutes, until he feels some nausea; then remove him from the bath, and put him in blankets: he is then to be placed between two strong posts, about ten feet asunder, in which two staples are fixed; or rings may be screwed into the floor, and the patient be laid upon it. My usual method is to place him on a table, covered with a thick blanket, upon his back; then a strong girth is passed between his pudendum and thigh, and this is fixed to one of the staples. A wetted linen roller is tightly applied just above the knee; and upon this a leathern strap is buckled, having two straps with rings at right angles with the circular part. The knee is to be slightly bent, but not quite at a right angle, and brought across the other thigh a little above the knee of that limb. The pulleys are fixed in the other staple, and in the straps above the knee. The patient being thus adjusted, the surgeon slightly draws the string of the pulley; and when he sees that every part of the bandage is upon the stretch, and the patient begins to complain, he waits a little, to give the muscles time to become fatigued; he then draws again, and when the patient suffers much, again rests, until the muscles yield. Thus he gradually proceeds until he finds the head of the bone approach the acetabulum. When it reaches the lip of that cavity, he gives the pulley to an assistant, and desires him to preserve the same state of extension; and the surgeon then rotates the knee and foot gently, but not with a violence to excite opposition to the muscles, and in this act the bone slips into its place." It is sometimes necessary for the operator to lift the bone, by placing his arm under it near the joint, when there is difficulty in bringing it over the lip of the acetabulum; or a napkin may be passed under the bone, as near the head as possible, and by its means an assistant may raise it.—*Sir A Cooper's Treatise, &c.*

It should be remembered that from the extreme relaxation of the muscles, the head of the bone is not always reduced with an audible snap; and that, from the same reason, after the reduction, great care is required in removing the patient to his bed.

Should dislocation of the hip be complicated with fracture of the thigh, which injury ought first to be treated?

1219. The fracture ought first to be attended to; and when the union of the bone has become sufficiently strong, an attempt at reduction of the luxation should be cautiously made; and this may be done at about five or six weeks after the accident.—*Ibid.*

What would be your treatment, should there be dislocation of the thigh on one side, and fracture of the thigh on the other?

1220. "In such circumstances I have fixed some splints temporarily, but very firmly, upon the broken limb, and then turning the patient on that side, have proceeded to the reduction of the dislocated hip in the usual way."—*Ibid.*

VAR. 2.—*Dislocatio in incissuram ischiaticam.* Dislocation into the ischiatic notch.

Describe the anatomy of the ischiatic notch.

1221. The ischiatic notch is situated at the posterior part of the ilium. It is bounded anteriorly and superiorly by that bone; posteriorly by the sacrum, and inferiorly by the sacrosciatic ligament. It gives passage to the pyriformis muscle, the sciatic nerve, and to the glutæal, ischiatic, and pubic arteries. It is situated posteriorly to the acetabulum, and a little above its level.—*Ibid.*

What is the exact position of the head of the femur in this dislocation?

1222. "In this dislocation the head of the thigh-bone is placed on the pyriformis muscle, between the edge of the bone, which forms the upper part of the ischiatic notch and the sacro-ischiatic ligaments, behind the acetabulum, and a little above the level of that cavity."—*Ibid.*

Is the detection of this variety easy to the surgeon?

1223. The detection is by no means easy, "because the length of the limb differs but little in its position, and its position, in regard to the knee and foot, is not so much changed as in the dislocation upwards."—*Ibid.*

What, then, are the true signs of this accident?

1224. "The signs of this dislocation are, that the limb is from half an inch to one inch shorter than the other, but generally not more than half an inch; that the trochanter major is behind its usual place, but is still remaining nearly at right angles with the ilium, with a slight inclination towards the acetabulum. The head of the bone is so buried in the ischiatic notch, that it cannot be distinctly felt, except in thin persons, and then only by rolling the thigh-bone forwards, as far as the comparatively fixed state of the limb will allow. The knee and foot are turned inwards, but less than in the dislocation upwards, and the toe rests against the ball of the great toe of the other foot. When the patient is standing, the toe touches the ground, but the heel does not quite reach it. The knee is not so much advanced as in the dislocation upwards, but is still brought a little more forwards than the other, and is slightly bent."—*Ibid.*

What is the best mode of reducing this luxation?

1225. "The reduction of the dislocation into the ischiatic notch is in general extremely difficult, and is best effected in the following manner: the patient should be laid on a table upon his side, and a girth should be placed between the pudendum and the inner part of the thigh, to fix the pelvis. Then a wetted roller is to be applied around the knee, and the leathern strap over it. A napkin is to be carried under the upper part of the thigh. The thigh-bone is then to be brought across the middle of the other thigh, measuring from the pubes to the knee, and the extension is to be made with the pulleys, (*Vide* 1218.) Whilst this is in progress, an assistant pulls the napkin at the upper part of the thigh with one hand, rests the other upon the brim of the pelvis, and thus lifts the bone, as it is drawn towards the acetabulum, over its lip. For the napkin I have seen a round towel very conveniently substituted; and this was carried under the upper part of the thigh and over the shoulders of an assistant, who then rested both his hands on the pelvis, as he raised his body, and lifted the thigh."—*Ibid.* Should the surgeon fail to lift the bone into the socket, he will sometimes succeed by rotating the head of the bone towards the acetabulum.

Is any other method of reduction sometimes practised?

1226. Sir A. Cooper mentions another method, which, however, he thinks inferior to the above. It is as follows: An extension is made by pulleys in a right line with the body, and at the same time the great trochanter major is thrust forward with the hand, when the bone returns into its socket with a snap.—*Ibid.*

Var. 3.—*Dislocatio super osse pubis.* Dislocation upon the pubes.

What are the symptoms of this variety of femoral dislocation?

1227. In this case "the limb is an inch shorter than the other; the knee and foot are turned outwards, and cannot be rotated inwards, but there is a slight flexion forwards and outwards; but the striking criterion in this dislocation is, that the head of the thigh-bone may be distinctly felt upon the pubes, above the level of Poupart's ligament, on the outer side of the femoral artery and vein; and it feels as a hard ball there, which is readily perceived to move, by bending the thigh-bone."—*Ibid.*

Is there any injury with which this luxation upon the pubes may be confounded?

1228. "This accident might, by an inattentive observer, be mistaken for a fracture of the neck of the thigh-bone; but the head of the bone felt upon the pubes will decide its nature."—*Ibid.*

It appears to me that it is scarcely possible to mistake this dislocation, and therefore that it would be inexcusable in any surgeon to do so.

In what manner ought the dislocation upon the pubes to be reduced?

1229. "The patient is to be placed on his side on a table; a girth is to be carried between the pudendum and inner part of the thigh, and fixed in a staple a little before the line of the body. The pulleys are fixed above the knee, as in the dislocation upwards (1218), and then the extension is to be made in a line behind the axis of the body, the thigh-bone being drawn backwards. After this extension has been for some time continued, a napkin is placed under the upper part of the thigh, and an assistant, pressing with one hand on the pelvis, lifts the head of the bone, by means of the napkin, over the pubes and edge of the acetabulum."—*Ibid.*

VAR. 4.—*Dislocatio in foramen ovale.* Dislocation into the foramen ovale.

State the anatomy of the thyroid foramen?

1230. The thyroid foramen is formed by the ischium and pubes. It is situated below the acetabulum, and is somewhat near the axis of the body. It is filled by a ligament, which proceeds from the edges of the foramen, and has an opening in its upper and anterior part, to permit the passage of the obturator vessels and nerve. It is covered on its external and internal surface by the obturator externus and internus muscles.—*Sir A. Cooper's Treatise, &c.*

State the lacerations which are caused by the head of the bone being thrust from the cotyloid cavity in this accident, and the precise situation in which the dislocated bone is found.

1231. "The ligamentum teres, and the lower part of the capsular ligament, are torn through; and the head of the bone becomes situated in the posterior and inner part of the thigh upon the obturator externus muscle."—*Ibid.*

Describe the appearances of this accident.

1232. "The limb is in this case two inches longer than the other. The head of the bone can be felt by pressure of the hand upon the inner and upper part of the thigh towards the perineum, but only in very thin persons. The trochanter major is less prominent than on the opposite side. The body is bent forwards by the tension of the psoas and iliacus internus muscles. The knee is considerably advanced: if the body be erect, it is widely separated from the other, and cannot be brought, without great difficulty, near the axis of the body to touch the other knee, in consequence of the extension of the glutæi and pyriformis muscles. The foot, though widely separated from the other, is generally neither turned outwards nor inwards, although I have seen it varying a little in this respect in different instances; but the position of the foot does not in this instance mark the accident. The bent position of the body, the separated knees, and the increased length of the limb, are the diagnostic symptoms."—*Ibid.*

What is the best method of reducing this luxation?

1233. "The reduction of this dislocation is, in general, very easily effected. If the misfortune be of recent occurrence, it is requisite to place the patient upon his back, to separate the thighs as widely as possible, and to place a girth between the pudendum and the upper part of the luxated thigh, fixing it to a staple in the wall. The surgeon then puts his hand upon the ankle of the dislocated side, and draws it over the sound leg, or if the thigh be very large, behind the sound limb, and the head of the bone slips into its socket:" or "the thigh might be fixed by a bed-post, received between the pudendum and upper part of the limb, and the leg be carried inwards across the other."—*Ibid.*

Is this method commonly successful without further fixing the pelvis?

1234. No: it will generally "be found necessary to place a second girth or bandage round the pelvis beneath that which I have already described, and the ends of this second girth should be fixed to a hook or staple, on the sound side of the patient, to prevent any lateral motion of the pelvis at the time that the injured extremity is drawn across the sound limb; otherwise the motion of the pelvis, following that of the limb, may prevent the reduction."—*Sir A. Cooper's Lectures, by Tyrrell.*

Should the bone have been longer dislocated, and the above method fail, have you any other in reserve?

1235. In such an event, "it is best to place the patient upon his sound side, to fix the pelvis by one bandage, and to carry under the dislocated thigh another bandage, to which the pulleys are to be affixed perpendicularly; then to draw the thigh upwards, while the surgeon presses down the knee and foot, to prevent the lower part of the limb from being drawn with the thigh-bone. Thus the limb is used as a lever of very considerable power. Great care must be taken not to advance the leg in any considerable degree, otherwise the head of the thigh-bone will be forced behind the acetabulum into the ischiatic notch."*—*Sir A. Cooper's Treatise, &c.*

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* It may not be unacceptable in this place to state, that in persons of lax fibre, it will be right to attempt the reduction of a dislocated limb by a rea-

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Genus 2.—*Fractura.* Fracture.

Species 1.—*Fractura simplex.*

Var. 1.—*Fractura cervicis femoris intra-capsularis.* Fracture of the neck of the femur within the capsule.

Is dislocation of the thigh-bone, or fracture at its upper part, the most frequent occurrence?

1236. The case of fracture is found to be the most frequent.

At what points of the upper part of the bone do fractures generally take place?

1237. Sir A. Cooper mentions three varieties of fracture at this part of the bone, viz., "1st. That in which the fracture happens through the neck of the bone entirely within the capsular ligament; 2dly, A fracture external to the ligament, through the neck of the thigh-bone, at its junction with the trochanter major; by which the trochanter is split, and the neck of the thigh-bone is received into its cancelli; 3dly, A fracture through the trochanter major, beyond its junction with the cervix femoris."—*Treatise on Dislocations.*

At what period of life does fracture, entirely within the capsule, usually occur?

1238. This injury rarely occurs but in old age, when a slight accident may occasion it, owing to the brittleness of the bone from interstitial absorption.

Is the male or female sex most liable to fracture within the capsular ligament?

1239. "Women are much more liable to this species of fracture than men; we rarely in our hospitals observe it in the latter, but our wards are seldom without an example of it in the aged female. The more horizontal position of the neck of the bone, and the comparative feebleness of the female constitution, are the probable reasons of this peculiarity." —*Ibid.*

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sonable extension at almost any period after the reception of the injury; but that in muscular persons such an attempt at a considerable distance of time from the accident, may be productive of very injurious effects, such as the laceration of muscles, the lesion of nerves, &c., and place the patient in a greater state of decrepitude than he was in before. On this point Sir A. Cooper has legislated as follows:—

"I am of opinion that three months after the accident for the shoulder, and eight weeks for the hip, may be fixed as the period at which it would be imprudent to make the attempt at reduction, except in persons of extremely relaxed fibre, or of advanced age."

State within what period of advanced age this fracture usually occurs, and contrast it with the period at which dislocation generally happens.

1240. Sir A. Cooper observes, from a field of vast experience—"This fracture rarely occurs under fifty years of age, and dislocation seldom at a more advanced period; although there are exceptions to this rule, for I have myself once seen the fracture at thirty-eight years of age, but it was very oblique, and a dislocation of the thigh at sixty-two; but the period of life between fifty and eighty years is that at which the fracture most usually occurs; for from the different state of the bone, the same violence which would produce dislocation in the adult, occasions fracture in old age."

What are the diagnostic appearances of fracture within the capsule?

1241. "The leg becomes from one to two inches shorter than the other; for the connexion of the trochanter major with the head of the bone, by means of the cervix, being destroyed by the fracture, the trochanter is drawn up by the muscles as high as the ligaments will permit, and consequently rests upon the edge of the acetabulum, and upon the ilium above it. The difference in the length of the limbs is best observed by desiring the patient to place himself in the recumbent posture on his back, when by comparing the malleoli it will be generally found that one leg is shorter than the other. The usual state of the limb is, that the heel on the injured side rests in the hollow between the malleolus internus and tendo achillis of the other leg; but there is some variety in this respect: a fork is sometimes formed in the trochanter minor, which catches the neck of the bone, and prevents a greater ascent than half an inch. Another circumstance which marks the nature of this injury is the eversion of the foot and knee; and this state depends upon the numerous and strong external rotatory muscles of the hip-joint, which proceed from the pelvis to be inserted into the thigh bone, and to which very feeble antagonists are provided: the obturatores, the pyriformis, the gemini and quadratus, the pectinalis and triceps, all assist in rolling the thigh-bone outwards, whilst a part of the glutæus medius and minimus, and the tensor vaginæ femoris, are the principal agents inward."—*Ibid.*

The psoas and iliacus internus muscles may also in some measure assist the former in rolling the foot outwards.

Is the eversion of the foot invariable in this fracture?

1242. No. "Inversion not unfrequently happens in this form of fracture, although the opposite state is that which, from a consideration of the muscles involved, is *à priori* to be expected."—*Liston's Elements.*

Can you explain the reason of the foot being sometimes inverted?

1243. "In fracture" says Mr. Liston, "the muscles do not act as in a sound limb; and when the limb is once placed, the patient will not, by his own efforts, alter the position."—*Ibid.*

Sir A. Cooper explains the inversion in the following manner:—"Several hours must elapse before this eversion assumes its most decisive character, as the muscles require some time to assume a determined contraction."—*Treatise on Dislocations, &c.*

Has not this occasional inversion of the foot sometimes misled the surgeon to consider the case a dislocation upwards?

1244. Mr. Liston says that "the inversion of the limb presents somewhat the appearance arising from the most common luxation;" and Sir A. Cooper states, "The surgeon having been called soon after the accident has happened, before the muscles had acquired that state of contraction to which they are liable, has been led to mistake the nature of the injury, because the foot is not so decidedly everted as it afterwards becomes; and, for this reason, patients, even in hospital practice, have been exposed to useless and painful extensions."

What would be your diagnosis on this point?

1245. The case of fracture "possesses greater mobility, and has not the want of prominence occasioned by displacement of the articulating extremity of the bone. The facility of lengthening the member, and the crepitation felt on a proper and more attentive manipulation, will remove all doubt."—*Liston's Elements.*

Do you consider pain to be in any wise diagnostic of the fracture?

1246. Pain will sometimes help the surgeon in his diagnosis. "The pain is felt in this accident in the upper and inner part of the thigh, opposite to the insertion of the iliacus and psoas muscles into the trochanter minor, or sometimes just below the point."—*Sir A. Cooper's Treatise, &c.*

"On examining the injured hip, motion to any extent can be effected, though with excruciating suffering to the patient." —*Liston's Elements.*

Will not the posture of the patient also sometimes aid you in distinguishing this injury?

1247. Placing the patient on his feet will frequently discover the shortening of the limb, which may be less evident in the horizontal position. Whilst standing, "the toes rest upon the ground, but the heel does not reach it; the knee and foot are everted, and the prominence of the hip is diminished." —*Sir A. Cooper's Treatise, &c.* The slightest bearing on the injured side produces pain.

You have stated that fracture of the neck of the femur within the capsule may be confounded with dislocation upon the dorsum ilii; might it not be confounded with dislocation in other directions?

1248. This case may be also confounded with the luxation into the ischiatic notch, and upon the pubes, as in both these directions the leg will be shortened.

By what marks could you distinguish these from the case of fracture?

1249. In the luxation into the notch the toe will be turned inwards, and the limb will be rigid. In fracture the toe will be turned outwards, and the limb mobile. In the luxation upon the pubes there will be tumour of the groin, from the head of the bone being lodged and felt there.

What degree of union is found to take place in fracture of the cervix femoris within the capsule?

1250. In persons of extreme old age, no union has been discovered to have taken place, neither can it be expected. In persons less advanced in age, and under favourable circumstances, soft union may be effected; and where the accident happens (which is a rare example) in a younger person, and the ends of the fracture are but little displaced, ossific union may result. It must, however, be confessed, that according to all the evidence that has been adduced, non-union is the general rule, and union of any kind the exception.

Can you explain the reason why no union can take place in persons of extreme age?

1251. Union at this period of life cannot take place by reason of interstitial absorption, and the consequent inadequacy of the feeble powers of organization left in the bone, to repair such an injury.

Can you assign a reason why union so rarely takes place in a fracture of the cervix femoris under more favourable circumstances, i. e., in less advanced age, where the organizing power is not so impaired?

1252. It might be explained from the almost impossibility to keep the fracture in apposition or at rest; from a want of vascularity in the surrounding tissues, especially in the head of the bone, which can only be supplied with arteries through the medium of the ligamentum teres; and from the intervention of increased synovial fluid. To these causes the want of any union at all, or the fibrous texture that commonly unites the fracture, when union takes place, may be fairly attributed.

Ought not the patient to be prepared to experience lameness after this kind of injury?

1253. The surgeon should not forget to do this in justice to his reputation, as shortening of the limb and some degree of lameness invariably result from this accident.

What is the treatment of fracture of the neck of the femur within the capsule in persons of very advanced age?

1254. "In these cases the application of apparatus, with the view of adapting and retaining the parts, is productive of great annoyance, and is apt to produce either ulceration or sloughing of the integuments at various parts; and confinement to one constrained position for a considerable time has a mischievous effect on the general health. Instead, the limb is placed in the easiest posture, either extended and slightly retained, or bent over a double-inclined plane formed by pillows, with the knee of the affected side fixed to the opposite; a broad band is passed round the trochanters and pelvis, so as to restrain motion without causing inconvenience; and when pain about the thigh is troublesome, fomentation may be used. After some weeks, when the uneasy feelings have subsided, the position is changed, the patient is set up, and encouraged to move about, supporting the weight of the body upon crutches."—*Liston's Elements.*

What treatment is required in cases supposed to be favourable to union?

1255. "In more favourable subjects," says Mr. Liston, "whether the fracture is suspected to be without or within the joint, either entirely or partially, the broken surfaces are to be brought in contact, and retained immoveably in apposition for a time sufficient to admit of union. The limb is put up in apparatus not requiring removal, and but little re-adjustment."—*Ibid.*

By what means can this treatment be the most effectually carried into execution?

1256. "This can be effected only in the extended position," and by the following simple apparatus:—"This is a straight wooden board, not too thick to feel cumbrous, and not too thin to be pliable or easily broken; in breadth corresponding to the dimensions of the limb, in length sufficient to extend from two, three, or four inches, beyond the heel to near the axilla; deeply notched at two places at its lower end, and perforated by two holes at the upper. The splint, well padded, is applied to the extended limb, the ankles being protected by proper adjustment of the pads. The apparatus is retained by bandaging. A common roller is applied round the limb from the toes to near the knee, so as to prevent infiltration, which would otherwise follow pressure above by the rest of the apparatus. The splint is then attached to the limb, by involving both by a roller from the foot to above the knee; and in doing this, the bandage, after having been turned round the ankle, should be passed through the notches, so as to be firmly attached to the end of the splint, thereby preventing the foot from shifting. A broad bandage is applied round the pelvis over the groin and down the thigh, investing all that part of the limb left uncovered by the previous bandaging. A broad band, like a riding-belt, is fastened round the pelvis, so as to bind the splint to the trunk, and thereby keep the broken surfaces of the bone in contact. A large handkerchief, or shawl, is brought under the perinæum, and its ends secured through the openings at the top of the board. It is evident that the splint being securely fixed and made as part of the limb, tightening of the perineal band will extend the member, and preserve it of its proper length. By care and attention in applying the apparatus, and in adjusting the cushions about the ankle and perinæum, there is little or no risk of the skin giving way. The bandages will require to be re-applied once or twice during the cure, and the perineal band should be tightened frequently."—*Ibid.*

VAR. 2.—*Fractura cervicis femoris extra-capsularis.* Fracture of the neck of the femur externally to the capsule.

Describe the symptoms of fracture of the cervix femoris external to the capsule.

1257. The symptoms of this accident in some measure resemble those of fracture within the capsule, and therefore require great care in the diagnosis.

"The injured leg is shorter than the other by one half to three-quarters of an inch; the foot and toe on that side are everted, from the loss of support which the body of the thigh-bone sustains in consequence of the fracture; much pain is felt at the hip, and on the inner and upper part of the thigh, and the joint loses its usual roundness."—*Sir A. Cooper's Treatise on Dislocations, &c.*

What are the diagnostic marks of this injury?

1258. This injury may be distinguished by its being followed immediately by ecchymosis, and very soon by inflammatory swelling and great tenderness, accompanied by irritative fever. As the retraction is very limited, crepitation is discovered by slight motion of the limb, without that extension which is necessary to produce the mark in fracture within the capsule*; and the former accident is always attended with much greater severity of pain than the latter.—*Ibid.*

Are there not other considerations that will materially assist the diagnosis?

1259. Should the accident occur in a young person, or in a person under fifty years of age, (such ages being liable to this kind of fracture) the surgeon will be warranted in the conclusion that the fracture is either just external to the capsule, or through the major trochanter. Again, should the accident happen to a person above the age of fifty years, our diagnosis may be assisted by the consideration of the degree of violence that has occasioned it. If the cause has been slight, our opinion should lean to fracture within the joint; if violent, then the injury is external to it.—*Ibid.*

Is there any occurrence which might tend to obscure the diagnosis in extra-capsular fracture?

1260. "It is that in which the upper fragment is driven a short distance into the cancellated structure of the bone, the ascent of which it not only prevents, but sometimes renders the restoration of the limb to its original length by extension a matter of extreme difficulty."—*Mr. Smith on Diagnosis of Fractures in the Neck of the Femur:" Dublin Journal.*

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* In the Dublin Medical and Chemical Journal, for November 1834, Mr. Robert Smith, Curator of the Museum of the Richmond Hospital, has published a paper, which was read before the Surgical Society of Ireland, disputing the doctrines of Sir A. Cooper on this subject. Mr. Smith asserts that there is less shortening of the limb in intra-capsular fracture, and greater in the extra-capsular. In the former, that the degree of shortening varies from a quarter of an inch to one inch; in the latter, from one inch and a half to two inches and a half; and founds this opinion from his own experience, and fifteen examples of fracture which occurred in the Richmond Hospital. In thirteen of these the degree of shortening was carefully noted, and they were inspected after death. It must be acknowledged there is great difficulty in diagnosticating with any thing like precision in these obscure cases. Sir A. Cooper may be incorrect, yet from the great pains he has taken to distinguish these injuries, and from the mass of respectable evidence he has brought to support his own opinion, I have chiefly selected his authority for my text.

This position of the fracture will obscure the diagnosis, not only by preventing the shortening of the limb, but by probably preventing the feeling of crepitation also.

What is the usual result of fracture external to the capsule?

1261. Ossific union, from the reparative powers of the surrounding parts; supposing, of course, that proper treatment has been adopted: there will be, however, a shortening of the limb.

How would you treat this species of fracture?

1262. In the same manner as was recommended at 1256, for some kinds of fracture within the capsule, by Mr. Liston. "In the treatment of this injury," says Sir A. Cooper, "the principle is to keep the bones in approximation by pressing the trochanter towards the acetabulum; and the length of the limb is preserved by applying a roller around the foot of the injured leg, and by binding the feet and ankles firmly together, so as to prevent their retraction, and thus cause the uninjured side to serve as the splint to that which is fractured, giving it a continued support. A broad leathern belt should also be buckled around the pelvis, including the trochanter major, to press the fractured portions of the bone firmly together; and the best position for the limb is to keep it in a straight line with the body."

The following is another treatment which may be adopted. "The patient being placed on a mattress on his back, the thigh is to be brought over a double-inclined plane, composed of three boards: one below, which is to reach from the tuberosity of the ischium to the patient's heel, and the two others having a joint in the middle, by which the knee may be raised or depressed. A few holes should be made in the board, admitting a peg, which prevents any change in the elevation of the limb but that which the surgeon directs. Over these a pillow must be thrown, to place the patient in as easy a position as possible. When the limb has been thus extended, a long splint is placed upon the outer side of the thigh, to reach above the trochanter major, and to the upper part of this is fixed a strong leathern strap, which buckles round the pelvis, so as to press one portion of the bone upon the other, and the lower part of the splint is fixed with a strap around the knee, to prevent its position from being altered."—*Treatise on Dislocations, &c.*

VAR. 3.—*Fractura per trochanterem majorem.* Fracture through the greater trochanter.

At what period of life does this fracture generally occur?

1263. Oblique fracture of the femur through the trochanter major occurs at any period of life, and is usually occasioned by considerable violence.

State the symptoms of this fracture.

1264. "The leg is very little, and sometimes not at all shorter than the other, and the foot is benumbed; in some cases the patient is unable to turn in bed without assistance, and the attempt gives him great pain. The broken portion of the trochanter major is, in some cases, drawn forward towards the ilium; in others it falls towards the tuberosity of the ischium, but is in general widely separated from that portion which remains connected with the neck of the bone. The foot is greatly everted: the patient cannot sit, and any attempt to do so produces excessive pain."—*Sir A. Cooper's Treatise on Dislocations.*

From the above statement it is clear that crepitation must with difficulty be discovered.

What are the distinguishing marks of this variety of fracture?

1265. "A fixed state of the upper part of the trochanter, whilst its lower part obeys the motion of the thigh-bone; eversion of the foot, and the very perceptible altered position of the trochanter major, attended with crepitus under very extended motion of the upper part of the limb, and with little diminution of its length."—*Ibid.*

Might not shortening of the limb take place in this case under certain circumstances?

1266. "When the fracture happens below the insertion of the principal rotatory muscles, the lower portion of the bone is much raised by the action of the glutæus maximus," and the limb is consequently very much shortened.—*Ibid.*

What is the kind of union that results from this fracture?

1267. "This fracture unites very firmly, and more quickly than when the cervix is broken at the root of the trochanter, and the patient recovers with a very good use of the limb."—*Ibid.*

VAR. 4.—*Fractura epiphysis trochanteris majoris.* Fracture of the great trochanter epiphysis.

What are the symptoms of a fracture of the great trochanter epiphysis?

1268. This fracture will be necessarily obscure when the muscles are not torn along with the fracture; indeed, it was impossible to detect it under such circumstances during the life of the patient, in a case that occurred to Mr. Key, of Guy's Hospital. When, however, the glutæus medius, minimus, and upper part of the vastus externus, are torn through along with the fracture, the epiphysis will be found drawn upwards, and the nature of the injury easily detected.

What treatment have you to recommend in this injury?

1269. It is manifest that, should the epiphysis be considerably separated from the shaft of the bone, the case will be but little under our control, and that the most we can expect is fibrous union. Perfect rest should be enjoined for a sufficient length of time, and the leg maintained in the straight position.

VAR 5.—*Fractura columnæ femoris.* Fracture of the shaft of the thigh-bone.

Does not fracture sometimes occur to the shaft immediately below the trochanters?

1270. This is sometimes met with. It is a fracture of very difficult management, and if the treatment be not judicious, great distortion ensues.

What are the symptoms of this fracture?

1271. "The end of the broken bone is drawn upwards and forwards, so as to form nearly a right angle with the body, and the cause of this position is evidently the contraction of the iliacus internus and psoas muscles, assisted by the pectinalis, and perhaps by the first head of the triceps."—*Sir A. Cooper's Treatise on Dislocations, &c.*

Would you endeavour to press down the projecting bone?

1272. Such a measure would be utterly useless, as it could in no wise preserve the bone in its proper place, and add only to the sufferings of the patient.

State the treatment which ought to be adopted.

1273. "To prevent this horrid distortion and imperfect union, two circumstances are to be strictly observed: the one is to elevate the knee very much over the double-inclined plane, and the other to place the patient in the sitting position, supporting him by pillows during the process of union. The degree of elevation of the body, which is required, will be about forty-five degrees; but it may be readily ascertained by observing the approximation of the fractured extremities of the bones; and this position is requisite for relaxing the psoas and iliacus muscles, and thus preventing the elevation of the upper part of the bone. In no other manner can the great deformity I have described be prevented. When by this posture the extremities of the bones are brought into proper apposition, and all projection of its upper portion is removed, either the splints may be applied which are commonly used in fracture of the thigh-bone, or, what is better, a strong leathern belt, lined with some soft material, should, by means of several straps, be buckled round the limb, and be confined by means of a strap around the pelvis."—*Ibid.*

What are the symptoms of fractured femur at the middle third of the shaft?

1274. The nature of this case is too plain to be mistaken: indeed, the eye of the surgeon will at once detect the fracture from the deformity of the limb, before he proceeds to confirm his opinion by any manipulation whatsoever.

Would you at once adjust the displaced fractured ends of the bone, or proceed in the first place to reduce the swollen or inflamed state of the limb?

1275. I should immediately (in common phrase) proceed to "set the fracture*;" for "no greater absurdity and cruelty is conceivable than leaving the fracture unadjusted for weeks, making attempts to subdue consequent over-action, and then endeavouring to reduce and retain the bones at a period when otherwise they should have been firmly united."—*Liston's Elements.*

In what position ought the limb to be placed, when the thigh is fractured at the middle third?

1276. This fracture may be "managed easily and well on the double-inclined plane—M'Intyre's splint, the thigh piece of which is double, the one portion sliding on the other, and made to shorten or lengthen, by means of a screw, without removal from the patient. To this the limb is secured by bandaging from the toes upwards; the upper bandage, which should be broad, being continued close to the perinæum, and then passed several times round the loins. By elongating the thigh-piece by means of the screw, extension is kept up."—*Ibid.*

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* The first question put to a surgeon by the friends of a patient who has met with the misfortune to break a bone, is—"Is the bone set, sir?" And should the surgeon answer in the negative, a want of confidence in his skill will be often the consequence, whatever argument he may make use of as to the necessity of first reducing the inflammation. Indeed, there is much good sense on their side; for however advisable it may be to subdue tumefaction before *any decided compression* is applied, it must always be judicious and right to endeavour to place the fractured ends in apposition, this being of itself one grand means of diminishing irritation and inflammation.

Do you consider this plan preferable to placing the limb on its outside in the bent position?

1277. Decidedly. " There is no possibility of treating fracture of the thigh with any satisfaction or credit on the outside of the limb with the knee bent; however attentively the splints are placed, shortening, eversion of the foot, and deformity of the whole limb, are sure to follow."—*Ibid.*

What is generally the relative position of the fractured ends of the bone, when the shaft of the femur is broken just above the condyles?

1278. The fractured end of the shaft projects, and the distal extremity, with the patella, is drawn up behind it, producing great deformity.

Is there any appearance that would lead us to presume the fracture to be oblique?

1279. In the oblique fracture the lower extremity of the shaft of the femur would probably pierce the rectus femoris muscle, and press against the integuments just above the patella. A sharp point of bone in such a position would be sufficiently diagnostic of the nature of the fracture.

What mode of treatment does a fracture of this part of the femur require?

1280. It will be absolutely necessary in this formidable accident to keep up continued extension, to preserve that retraction which might otherwise take place; and this will be best effected on the double-inclined plane by M'Intyre's splint. *Vide* 1276.

What would be your treatment should the sharp end of the shaft in oblique fracture have penetrated the rectus femoris muscle?

1281. Our first object will be to reduce the fracture by steady and continued extension, and having done this, to maintain the bones *in situ* by extending and bandaging the limb upon M'Intyre's double-inclined plane, as has been just mentioned.

Should you have occasion to use the common splints in addition to the double-inclined plane, what ought to be their length relatively to the femur?

1282. They ought to be long enough to secure as much as possible the ends of the femur; if they be shorter than this, and applied to the shaft only, they can have no power in steadying the fracture.

Species 2.—*Fractura composita.* Compound fracture.

Var. 1.—*Fractura cervicis femoris composita.* Compound fracture of the neck of the femur.

What is the usual cause of compound fracture of the neck of the femur?

1283. The velocity of projectile bodies, such as gun-shot.

Is this species of injury easily ascertained?

1284. Where the neck of the bone is broken asunder, the nature of the case will be detected by the diagnostic signs of simple fracture, as stated at 1241 and 1258; but where a musket-shot penetrates the bone, without breaking it asunder, the discovery of the true nature of the injury is extremely difficult. "In some of these cases," says Dr. Hennen, "the course of the ball is so obscure, and its place of lodgment so uncertain, that it can only be detected after death. I have seen balls lodged in almost every part of the trochanters, neck and head of the bone; and yet the most accurate examination during life did not lead to a discovery of their situation."—*Principles of Military Surgery.*

Are not injuries of this kind, either within or near the hip-joint, extremely hazardous to life?

1285. "The injuries occasioned by balls lodging near or about the joint of the hip, are among the most serious of military surgery," much more those of the joint itself; "the fever, the profuse discharges, the tedious exfoliations, all tend to sink the patient, and are but too often fatal."—*Ibid.*

What treatment would you adopt, should you be called early enough to discover a musket-ball lodged in the trochanter?

1286. It is possible, if the surgeon is early called in, and can at once decide on the nature of the case, that the application of the crown of a trephine, aided by strong forceps, may enable him to remove the ball, if thus lodged.—*Ibid.*

State the compound injuries of the upper part of the femur that require primary amputation of the hip-joint.

1287. The cases which call for primary amputation, principally arise from grape or cannon-shot, or from the explosion of shells, by which the bones in the immediate vicinity of the joint are severely fractured, or the soft parts and blood-vessels extremely lacerated.—*Ibid.*

The following examples are pronounced by Mr. Guthrie to require the primary operation :—

1st. " A grape or small cannon-shot may strike the fore part of the thigh, and without wounding the inguinal artery itself, may, in its passage to the neck of the femur, wound some large arterial branches, causing considerable hemorrhage: the wound shall not be large, and yet the chance of saving the life of the patient will be but very small indeed.

2dly. " A shell, bursting near a soldier, may drive a large piece, of an inch in thickness, and a pound or two in weight, into the inner part of the thigh, without wounding the femoral artery, yet fracturing the head of the bone; here several large vessels, and, perhaps, the great sciatic nerve, would be divided; and the only chance of life, in my mind, would be in the immediate removal of the whole.

3dly. " A piece of a shell may strike between the trochanter and the ilium, go through the neck of the bone, and tear its way out below the tuberosity of the ischium, destroying all the parts in its course, without either killing the soldier by hemorrhage, or by the shock of the blow to the constitution.

4thly. " When a cannon shot carries away the thigh above its middle, so as to exclude the more common flap operation close to the trochanter, it is almost always fatal," and requires the operation.

5thly. " A cannon-shot striking the outside of the thigh, tearing away the trochanter and surrounding parts, without wounding the femoral arery, or any great vessel that would cause any serious hemorrhage, or so great a shock to the constitution as to render the operation impracticable."—*Guthrie on Gun-shot Wounds.*

But might not an injury of the neck of the bone by a musket-shot call also for the primary operation?

1288. " Few surgeons would think of performing it for a wound by a musket-ball, although cases may occur that require it; and the principal one that will render it necessary will be a fracture of the head or neck of the bone, with a wound of the great vessels, or some other arterial trunk, causing hemorrhage, and stuffing the thigh with blood."—*Ibid.*

Mr. Brodie performed this operation during the night, in St. George's Hospital, for a wound of this kind.

Should you have reason to suppose the bones of the pelvis to be injured along with either of the foregoing injuries, would you deem the operation justifiable?

1289. " If the bones of the pelvis are injured in any of the preceding kinds of accident, the result will be fatal, and the operation should not be performed."—*Ibid.*

Would an injury of the soft parts, however extensive, justify the performance of this operation?

1290. "A very extensive injury of the soft parts of the thigh, if the bone be not broken, and the femoral artery not divided, does not authorize the operation, although the artery be laid bare for three or four inches of its course."—*Ibid.*

Does not this formidable operation generally prove fatal in its results?

1291. It must be confessed that it has not often been followed by recovery; and when we consider that one-fourth of the human body is removed by this amputation, we are not to be surprised at such a result. Still, however, several cases of recovery from it are on record; and "these cases prove," says Mr. Guthrie, "that the operation is not only necessary, but practicable, and that it may be effected with success under certain circumstances. This being granted, it necessarily follows, that this operation ought to be recommended and performed in every case, in which it can alone bring relief, or offer a prospect of success. No man should, therefore, be allowed to die, without its being proposed to him," when found in so awful a catastrophe.

How long after the reception of the injury ought the primary operation to be performed?

1292. "The sooner it is done on the field of battle, consistent with propriety, the greater will be the chance of success, for the patient cannot live to the period for secondary amputation. It is in this, and other operations high in the thigh, that the question of time is most important; for haste is as injurious as delay, when improperly applied."

State the condition of the constitution that would forbid the immediate performance of the operation?

1293. "If the patient has suffered much loss of blood, or is in a state of syncope, or nearly approaching to it, unable to articulate, with a pulse scarcely perceptible, and the skin clammy and cold, an immediate operation would only hasten his death."—*Guthrie on Gun-shot Wounds.*

Ought a patient with such a tremendous wound, and in such a desperate condition, to be considered moribund, and therefore abandoned by the operator?

1294. No. "If excited by stimulants and cordials, he will have some chance of recovering himself in an hour or two, so as to undergo the operation with a better prospect of success, or he will in that period sink and die."—*Ibid.*

In the next place, describe the state of a patient under a similar injury, which will justify the immediate performance of the hip amputation.

1295. " If, on the contrary, he is brought to the surgeon, although much alarmed and reduced by the sudden shock and loss of blood, with strong sensations of pain, expressed by his cries for assistance, convulsive motions of the limb and body, and the powers of the sensorium not destroyed, the operation should be performed immediately; or, instead of becoming more calm and collected, he will gradually sink into the state of the first described, and be unable to bear the operation."—*Ibid.*

Having stated what condition of the patient will probably enable him to endure such an operation, and what will not, I would ask what ought to be the qualifications of the surgeon who would perform it ?

1296. " No surgeon," says the same author, " should attempt it, unless he is conscious of possessing great coolness, a presence of mind equal to any emergency, and a correct knowledge of the parts to be divided*."

Does not the dread of hemorrhage in this case too much intimidate the mind of the surgeon ?

1297. The dread of hemorrhage certainly too often shakes his hand, and embarrasses his judgment. This dread he must endeavour to overcome, otherwise he will not be adequate to perform an operation of this importance. Besides, the difficulty of controlling hemorrhage is not so great as to warrant such a dread. " The larger the artery the more easily it is secured, and the femoral artery the most readily of all. The smaller vessels only require the ends of the fingers to be placed upon them to stop the flow of blood; and this support, which hardly amounts to compression, is sufficient for vessels of considerable size, such as the branches of the glutæal, sciatic, and obturator arteries, to be divided in the course of the operation. The femoral artery in the groin can always be held with ease between the finger and thumb, or pulled out by a tenaculum, until a ligature be put around it."—*Guthrie on Gun-shot Wounds.*

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* This observation of Mr. Guthrie surely proves the duty of every surgeon to keep up his knowledge of anatomy, that he may be prepared to meet those serious emergencies which he may be called upon to treat at any hour of his professional life.

What parts are divided in amputation at the hip-joint?

1298. The integuments, cellular and adipose membrane, vaginal fascia, twenty-one muscles, the capsular and round ligaments, besides the blood-vessels and nerves.

What are the more superficial muscles, and what are those more immediately surrounding the joint, which are cut through?

1299. The more superficial are, the tensor vaginæ femoris, the sartorius, the rectus femoris, the gracilis, semi-tendinosus, semi-membranosus, triceps adductor femoris, long head of the biceps, and glutæus maximus—in all ten. Those surrounding the joint are, the glutæus medius and minimus, iliacus internus, psoas, pectinæus, obturator externus, quadratus femoris, obturator internus, gemini and pyriformis—in all eleven, and the whole twenty-one. "The knowledge of the insertions of these muscles will enable the surgeon to understand and obviate any difficulty that may arise in dislocating the head of the femur."—*Guthrie on Gun-shot Wounds.*

What are the arteries which are divided in this operation?

1300. The femoral, the obturator, the ischiatic, and glutæal arteries.

State the relative position of the femoral artery at the upper part of the thigh.

1301. "At its first exit, it is situated superficially over the ball of the os femoris, having the inner edge of the common end of the psoas, and iliacus internus, between it and the joint. Further down, it is lodged deep in a hollow at the upper and inner part of the thigh, with the rectus and sartorius upon the outer, and the adductor femoris upon the inner side of it." As it issues from under the ligament, it has the anterior crural nerve on the outside, and the femoral vein on the inside.

Can this artery be compressed prior to or during the operation?

1302. "It may be compressed with certainty where it passes over the brim of the pelvis."—*Guthrie on Gun-shot Wounds.*

Describe the course of the obturator artery after it has perforated the obturator ligament.

1303. The obturator artery, after perforating the ligament, divides into branches, one set of which are dispersed upon the parts above the hip-joint, while another belong to the obturator externus, and to the muscles which are situated at the upper and inner part of the thigh. This artery is not compressible previously to the operation; but it is not of great size.

What is the course of the sciatic artery as it escapes from the pelvis?

1304. The sciatic artery, the largest of the iliac branches except the glutæal, goes through the under part of the ischiatic notch, accompanied by the nerve of that name, having the pyriformis muscle between it and the glutæal artery. It afterwards descends some way down the thigh, in company with the sciatic nerve, in the hollow between the great trochanter of the thigh-bone and tuber of the ischium, covered by the glutæus maximus muscle, to the under part of which it distributes its principal branches.—*Vide Fife's Compendium.* This artery is not compressible before the operation.

State the relative position of the glutæal artery.

1305. " The glutæal artery is given off before the sciatic in the pelvis, comes out above the pyriformis muscle, and principally supplies the outside of the haunch. One large branch descends between the glutæus maximus and medius towards the thigh, supplying these muscles.—*Guthrie on Gun-shot Wounds.* This vessel also is not compressible before the operation: " A branch or two may bleed during the operation, but they are not of much importance."—*Ibid.*

Will not the femoral vein generally require a ligature?

1306. " The femoral vein is large, and will require a single thread to be placed over it."—*Ibid.*

Describe what you consider to be the best method of amputating the thigh at the hip-joint.

1307. The following is Mr. Guthrie's mode of operating:—

" The patient should be laid on a low table, or two field-panniers placed together, covered with a folded blanket to prevent the edges giving pain, and properly supported in a horizontal position. An assistant, leaning over and standing on the outside, should compress the artery against the brim of the pelvis, with a firm, hard compress of linen; such as is usually used before the tourniquet. He should also be able to do it with his thumb behind the compress, if it be found insufficient.

" The surgeon, standing on the inside, with a strong pointed amputating-knife of a middle size, with the back curved, makes his first incision through the skin, cellular membrane, and fascia, so as to mark out the flaps on each side, commencing about four fingers' breadth, and in a direct line, below the anterior superior spinous process of the ileum in a well-sized man; and continuing it round, in a slanting direction at almost equal distance from the tuberosity of the ischium, nearly opposite to the place where the incision commenced.

"Bringing the knife to the outside of the thigh, he connects the point of incision, where he left off, with the place of commencement, by a gently curved line, by which means the outer incision is not in extent more than one-third of the size of the internal one. The integuments having retracted, the glutæus maximus is to be cut from its insertion in the linea aspera, and the tendons of the glutæus medius and minimus from the top of the trochanter major. The surgeon now placing the flat end of the knife on the line of the retracted integuments of the first incision, cuts steadily through the whole of the muscles, blood-vessels, &c. on the inside of the thigh. The artery and vein, or two arteries and vein, if the profunda is given off high up, are to be taken between the finger and thumb of the left hand, until the surgeon can draw out each vessel with the tenaculum, and place a ligature upon it. Whilst this is doing, the assistants should press with their fingers on any small vessels that bleed. The surgeon then cuts through the small muscles running to be inserted between the trochanters, and those on the under part of the thigh, not yet divided, and with a large scalpel opens into the capsular ligament, the bone being strongly moved outwards, by which its round head puts the ligament on the stretch. Having extensively divided it on the fore and inside, the ligamentum teres comes into view, and may readily be cut through. The head of the bone is now easily dislocated, and two or three strokes of the knife separate any attachment the thigh may still have to the pelvis. The vessels are now carefully to be secured. The capsular ligament and as much of the ligamentous edge of the acetabulum may be removed as can readily be taken away. The nerves, if long, are to be cut short, the wound well sponged with cold water, and the integuments brought together in a line from the spinous process of the ileum to the tuberosity of the ischium. Three sutures will in general be required, in addition to the straps of adhesive plaister, to keep the parts together: the ligatures are to be brought out in a direct line between the sutures; a little lint and compresses are to be placed over the wound, and on the under flap, to keep it in contact with the cotyloid cavity, and assist the union of the parts. A piece of fine linen is to be laid over them, and the whole retained by a calico bandage put round the waist and brought over the stump."—*On Gun-shot Wounds.*

Would you not pare the cartilage of the acetabulum?

1308. This would be bad practice; add in some measure to the sufferings of the patient, and be a sad loss of time.

It is manifest that you have made choice of flaps, presuming the external injury to be such as to allow you to do so; but suppose this line of incision could not be adopted, what practice have you to recommend?

1309. "This operation being considered necessary, it must, like all others, be done with reference to the parts remaining uninjured; but there is in general more choice in this instance than in many other operations; for the patient will seldom survive an injury, or the operation be recommended, in which there is not an opportunity of selecting the parts to be retained for the formation of flaps."—*Ibid.*

What treatment of the patient will be necessary after this severe operation?

1310. "The after-treatment will be the same as in other cases of amputation: the shock, however, of the injury and the amputation will be so great, that antiphlogistic regimen, to the extent of blood-letting, will not be necessary. If the patient be very low, cordials in small quantities, with opiates, should be given, and a light nourishing diet."—*Ibid.*

Species 2.—*Fractura columnæ femoris composita.* Compound fracture of the shaft of the femur.

What treatment would you adopt in compound fracture of the shaft of the femur?

1311. "Compound fracture of the thigh, if circumstances do not forbid attempts to save the limb, is to be reduced and retained in the same way as the simple, the wound being attended to, and means taken to subdue inflammatory action."—*Liston's Elements.*

Are there not cases of compound fracture of the femur, not requiring amputation, which cannot be reduced in the manner advised?

1312. It not unfrequently happens that the fractured end of the bone is so protruded as not to admit of reduction, and must be replaced by enlarging the wound, or be removed by the saw.

Which of these methods is to be generally preferred in compound fracture of the thigh?

1313. The better practice in this case is to enlarge the wound, if, by so doing, the bone can be fairly got down into its place. But it must be recollected, that, in order to do this effectually, it will sometimes be necessary to enlarge the opening through the muscles also.

It will not be sufficient to restore the bone merely through the integuments: this will be of little or no avail.—*Hammick's Practical Remarks on Amputations, &c.*

State your reason for preferring the enlarging the wound in protrusions of the femur.

1314. "I always wish to avoid sawing off any portion of bone, because the thigh must be to that extent shortened; and wherever the bone is removed, it will be always followed with great swelling, and when the inflammatory stage is over, there will be profuse purulent discharge."—*Ibid.*

In what position ought the limb to be placed?

1315. This will depend on what part of the bone is fractured. If the fracture be situated high up towards the trochanters, the position must be such as was recommended for simple fracture at that part of the femur, *vide* 1273: if at the lower end of the shaft, just above the condyles, the position should be such as was advised at 1280 and 1281; but should the injury be situated in the middle third of the thigh, Mr. Hammick recommends the limb to be placed in the straight position. His reasons are the following. "You will find, by the leg hanging down the lower side of the plane, that the knee will thrust up the inferior part of the bone out of its level, and that the upper part of the thigh will be disturbed by every movement of the body. The greatest objection to the double-inclined plane is, in a large suppurating fracture of the thigh, allowing the matter to insinuate itself, by its own gravitation, up amongst the muscles towards the nates, producing pain by its lodgment; and, should the limb require ultimately to be cut off, the muscles will be found in a flabby and unhealthy state, from the insinuation and soaking of the matter."—*Ibid.*

Ought not the bed to be carefully prepared for a fracture of the thigh?

1316. It is a matter of great importance that the bed should be so arranged, that "it be not too hard to gall, nor too soft to sink down." The sacking also should be drawn quite tight.—*Ibid.*

State the best method of supporting and bandaging the limb, when placed in the straight position you have just recommended.

1317. I would adopt the plan advised by Mr. Hammick. Let two sheets be folded into a square of about two feet, and spread out upon it a regular transverse row of short calico compresses; the row being in length sufficient to envelop the whole thigh, and each compress being long enough to embrace and overlap it. Upon these the limb is to be placed, and at this point of time our attention must be occupied in adjusting the fracture and closing the wound.

I would here ask you in what manner the wound is to be closed?

1318. The treatment of the wound will depend upon its character. Should it be an incised wound from a sharp instrument, let the edges be brought "gently into contact, though no closer than can be done by the easiest means," by adhesive straps, and over these place layers of dry lint; but should the wound be extensive and much lacerated, the applications may be as follow:—"To the wound we first apply a piece of dry lint, and over that another, well soaked in a solution of gum-arabic. If gum cannot be procured, you may substitute the white of eggs. Over this a little flour may be dusted, then another layer of gum and lint may be laid on; and lastly, two or three more of lint."—*Hammick's Practical Remarks, &c.*

You may now proceed with your method of bandaging, &c.

1319. Having closed the wound by one of these methods, and reduced the fracture by proper extension, the short calico compresses are to be folded around the thigh from the knee upwards, and the edges of the sheet turned in, "so as to form a protecting cushion on either side of the limb against the pressure of the common deal splints, which are to be secured by tapes: two splints will be all that are required; one long enough to reach from above the trochanter major to below the knee-joint, the other from the fork of the thigh by the side of the scrotum, to the inner side of the knee, filling up all the hollows in every direction with tow, and protecting every part that is likely to be galled."—*Ibid.* Lastly, a sponge-full of cold water, or goulard-wash, may be squeezed out over the compresses, avoiding, of course, that part of them which covers the wound, in order that the adherent applications may not be detached. Some support should be interposed between the bed and bed-clothes that cover the fractured thigh, to promote evaporation, and keep the limb cool.

State the circumstances which would forbid any attempts to save the limb in a compound fracture of the thigh.

1320. First, when the wheel of a loaded waggon, or the pressure of any pondrous body, fractures the thigh-bone into fragments, extensively lacerating and bruising the integuments, muscles, nerves, or blood-vessels, the case requires immediate amputation.—*Pott.*

Secondly. " A cannon-shot in full force, breaking the bone in any way, with a wound of the integuments, will always require amputation; and if the integuments be not divided in consequence of the diminished velocity of the ball, it will yet in general be necessary, from the comminuted nature of the fracture, and the total disorganization of the soft parts between; but these cases are of rare occurrence."—*Guthrie on Gun-shot Wounds.*

Thirdly. " An injury of the artery, requiring an operation, accompanied by fracture of the bone of the most simple kind, is a proper case for immediate amputation; for although many patients would recover from either accident alone, none would, I believe, surmount the two united, and the higher the accident is in the thigh, the more imperious is the necessity for amputation."—*Ibid.*

Fourthly. " When the femur is shattered by a musket-ball, and there is every reason to believe the fracture extends into the joint, the case requires immediate amputation."—*Ibid.*

Fifthly. " If the fracture did not communicate with the joint, when the middle of the body of the bone is broken into several large pieces, it is better to amputate before the inflammatory symptoms come on than afterwards; for it must then be done higher up, or probably cannot be done at all."—*Ibid.*

Does not the result of compound fracture of the femur in some measure depend on what part of the bone has been struck?

1321. "The danger and difficulty of cure attendant on fractures of the femur from gun-shot wounds, depend much on the part of the bone injured; and in the consideration of these circumstances, it will be useful to divide it into five parts. Of these, the head and neck included in the capsular ligament may be considered the first; the body of the bone, which may be divided in three parts; and the spongy portion of the lower end of the bone, exterior to the capsular ligament, forming the fifth part. Of these, the fractures of the first kind are, I believe, always ultimately fatal, although life may be prolonged for some time. The upper third of the body of the bone, if badly fractured, generally causes death at the end of six or eight weeks of acute suffering. I have seen few escape, and then not with a useful limb, that had been badly fractured in the middle part. Fractures of the lower or fifth division are in the next degree dangerous, as they generally affect the joint, and the least dangerous are fractures of the lower third of the body of the bone."—*Ibid.*

Do you, then, wish to be understood, that when a musket-shot strikes and fractures that point of the femur, the case does not call for the primary operation, and may be trusted to the natural powers?

1322. This treatment will be justifiable when the bone is not much shattered; but if it be much shattered, the danger is great; so that, says Mr. Guthrie, "a fractured thigh by gun-shot, even without particular injury of the soft parts, is one of the most dangerous kind of wounds that can occur."—*Ibid.*

If a musket-ball have fractured the lower part of the bone, without injuring the knee-joint, is the primary amputation necessary?

1323. "Wounds from musket-balls, injuring the lower part of the bone, without communicating with the joint, do not require primary amputation; they are proper cases for delay, except there be great destruction of parts."—*Ibid.*

What would be your treatment should a musket-ball be found lodged in the condyle of the femur, without further fracturing or much splintering of the bone?

1324. "In all these cases the injury is comparatively simple in the recent state, and our duty is confined to watching the approach of inflammation, and removing any splinters, &c. that may present or come within our reach."—*Hennen's Principles of Military Surgery.*

Absolute rest, cold applications, and the antiphlogistic regimen, will be of course necessary.—*Vide* 1041.

Are there not considerations relative to the future comfort and condition of the sufferer, which, in very equivocal and doubtful cases, would influence your decision either to amputate or endeavour to save the limb?

1325. If the accident happen in the field of battle, and "if the heat of the weather be great, as in the summer of the Peninsula, Asia, America, the hospital to which the patient must be removed at some distance, the conveyance bad, or the wounded very numerous, it is better to amputate even in a doubtful case."—*Guthrie on Gun-shot Wounds.*

On the contrary, if cool apartments in summer, good conveyance, plentiful attendance, and good professional advice can be procured, we may attempt to save the limb. Should such a case occur in private practice, such an attempt will be still more encouraged.

In severe compound fractures, where there is the greatest difficulty in deciding between the preservation or amputation of the limb, which alternative is best supported by the result of experience?

1326. "*I am well convinced*," says the late experienced Dr. Hennen, "*the sum of human misery will be most materially lessened, by permitting no ambiguous case to be subjected to the trial of preserving the limb;* constitution, convenience for treatment, and local circumstances, having their full weight in the decision."—*Principles of Military Surgery.*

SPECIES 3.—*Vulnus proprium.* Wound occurring to the thigh.

What is the situation and extent of the femoral artery?

1327. "The femoral artery is placed along the anterior and inner side of the thigh, extending from Poupart's ligament, where it is continuous with the external iliac, as far as the junction of the middle with the inferior third of the thigh, at which point it changes its name and relation to the bone, becoming popliteal."—*Quain's Elements of Anatomy.*

Define the course of this vessel by a line drawn longitudinally along the anterior and inner surface of the thigh.

1328. "If the knee be semiflexed, and the limb rotated outwards, so as to turn the flat or inner side of the thigh somewhat forwards, the course of the vessel may be marked out by a line drawn, or a cord extended, from midway between the anterior superior spine of the ileum and the symphysis pubis, to the lower border of the patella."—*Ibid.*

Describe the relative position of the femoral artery in its whole course.

1329. "It lies first on the psoas muscle (supported on its inner border), which separates it successively from the os pubis, the brim of the acetabulum, and the hip-joint. Below this, the vessel rests on some branches of the profunda artery and vein, embedded in cellular tissue; these separate it from the pectineus and adductor femoris: it then passes over the adductor longus, and finally over the conjoined tendons of the latter and adductor magnus. Internally, it is in contact with the femoral vein, both vessels lying on the same plane in the first instance, where they are supported by the pubes; but when the vein sinks behind the artery, the latter comes into the contact with the adductor longus and sartorius muscles. Externally it rests against the psoas muscle, which separates it from the crural nerve; but after that muscle has sunk backwards to its insertion, three or four branches of the nerve come into contact with the sheath of the vessels.

The anterior surface of the artery in the superior third of the thigh is covered only by the common integuments, the superficial fascia, the inguinal glands, and the fascia lata, so that it is comparatively superficial, and may be easily compressed against the acetabulum and head of the femur. In the middle third of the thigh, the vessel is more deeply seated, as, in addition to the parts already mentioned, it is covered by the sartorius muscle, beneath which may be observed a fascia, composed of oblique fibres, passing from the adductor muscles to the vastus internus. This is thin superiorly, beginning where the sartorius overlaps the vessels, but gradually becomes dense and firm as it approaches the point at which the vessel passes through the opening in the adductor magnus."—*Ibid.*

What is the relative situation of the femoral vein to the artery?

1330. "As the vein descends, it gradually sinks backwards, coiling round the artery, so that on reaching the popliteal space it is situated to the outer side and behind that vessel." —*Ibid.*

State the relative position of the crural nerve to the femoral artery.

1331. The crural nerve, at its exit from the abdomen, lies about three-quarters of an inch to the outside of the artery, being separated from it by the breadth of the psoas muscle; but when the muscle sinks backwards towards the trochanter minor, two or three branches of the nerve incline towards the artery, and accompany its sheath for some way; of these, the largest, which from its ultimate distribution is called nervus saphenus, pierces the sheath, and lies on the superior and external side of the artery, during the middle part of its course, whilst the vein is situated posteriorly and internally for the same extent. This nerve does not accompany the artery and vein, as they pass backwards through the adductor magnus; it continues directly downwards to the inner condyle of the femur, and may be found between the tendons of the gracilis and sartorius muscles."—*Ibid.*

Describe briefly the situation and primary course of the profunda artery.

1332. "The profunda arises from the external and posterior surface of the femoral artery, usually from an inch and a half to two inches below Poupart's ligament. It at first inclines outwards in front of the iliacus muscle, but soon changes its direction, running downward and backwards behind the femoral artery."—*Ibid.* The trunk of the profunda in this course lies at first on the psoas and iliacus muscles after their junction, then on the pectineus and adductor brevis, and finally on the adductor magnus. In the first part of its course, it is separated from the femoral artery by the femoral and profunda veins, and by a quantity of cellular tissue, in which all these vessels lie embedded."—*Ibid.*

At what situations may the femoral artery be tied?

1333. "The femoral artery may be tied on the superior or middle third of the thigh; the former situation," says Dr. Quain, "is now universally preferred, because the operation in the latter is considerably more difficult of execution, without securing any equivalent advantage."—*Ibid.*

Describe the mode of operating in the superior third of the thigh.

1334. "The limb being placed in the position pointed out at the commencement of these remarks, (1328), an incision is made through the integuments, beginning two inches below the middle point of Poupart's ligament, and carried perpendicularly downwards for three inches, or a little more, in a muscular fat subject. The fascia lata being exposed, a small part of it should be pinched up with the forceps, and cut across so as to form a small opening, into which a director is to be passed, in order that the fascia may be safely divided upon it. The sheath of the vessels is thus brought into view; a small part of which should be raised by the forceps and divided, the knife being held in the horizontal position. The vein in this situation will be found behind, and a little to the inner side of the artery; on which account, in carrying the needle round the latter, its point is to be directed from within outwards, and cautiously insinuated between them, its surface being held close to the artery. Some difficulty is generally experienced in effecting this step of the operation. The point of the needle is said to be hitched on "some tough cellular membrane," which is pushed onwards, and requires to be divided before the needle can be fairly protruded. This resistance is owing to the sheath of the vessels, now loose after its division, and readily caught into a fold by the point of the instrument."—*Ibid.*

At what part of the anterior and internal surface of the thigh would you make your incision for taking up the femoral artery in the middle third of the thigh?

1335. The surgeon is to explore with his fore-finger the course of the artery from the crural arch downwards, and when he comes to the place where the vibration of the vessel begins to be less distinctly felt, this point is to be fixed upon for the lower end of the external incision. The angle of the wound will fall nearly on the inner edge of the sartorius, just where this muscle crosses the track of the femoral artery, and at the very apex of the triangle formed by the convergence of the triceps and vastus intermus.—*Scarpa on Aneurism.*

About three or four inches above this point, the incision through the integuments and cellular tissue ought to be begun; it is then to be carried rather obliquely downward and inwards, following, in short, the track of the inner margin of the sartorius, till we arrive at the point of its crossing the artery, mentioned above.

Proceed with the description of the operation of tying the artery at this part of the thigh.

1336. "Any large branch of the saphena vein is to be avoided, and the first incision is to expose the fibres of the sartorius. The second incision is to separate the inner edge of the sartorius from the adductor longus femoris; and this merely divides the cellular tissue. The sartorius is then gently drawn outwards, and the sheath of vessels becomes exposed, in which, the artery, being more superficial than the vein, may be felt pulsating. A third incision opens the sheath, and this must be done with caution, as the sheath is to be divided over the artery. A septum is found between the artery and vein. The point of the silver knife may be here most safely used to further open the sheath, and to admit the probe. The probe is to be introduced under the artery with great care, to avoid injury to the vein, and to exclude any branch of the nerve, as I have known the saphenus nerve included in the ligature, and numbness produced in the course of the saphena vein. The probe being brought out at the wound, the ligature is then left under the artery. All this is to be effected with as little disturbance to the artery as possible. The ligature is to be then tied, first passed through twice, and then only once, in making the knot secure."—*Sir A. Cooper's Lectures, by Tyrrell.*

In what manner ought the wound to be treated?

1337. "When the ligature has been securely tied, cut off one of its ends, and leave the other hanging from the centre of the wound. Bring the edges of the skin exactly together, and secure them by adhesive plaister, leaving small interstices to permit the escape of discharge. Do not apply any bandage, and let the patient be carried to bed in the recumbent posture. Place the limb in a slightly bent position, rather on its outer side, and the foot is to be wrapped in flannel."—*Ibid.*

You have not said any thing of applying a tourniquet to the upper part of the thigh, or of any other means to check hemorrhage, in the event of a large vessel being wounded during the operation.

1338. The application of the tourniquet would be absurd, as it would distend the femoral veins and mask the artery. It may, however, be suffered to lie loosely around the limb both during and after the operation. When there are assistants at hand, it will be enough that one of them be ready to compress the artery in the groin, if it be required.

What is the treatment of a wound of the femoral artery high up in the groin?

1339. "The finger must be thrust into the wound, to stop the bleeding, until a compress can be applied upon the pubes and the vessel be secured."—*Sir A. Cooper's Lectures, by Tyrrell.*

In wounds of the femoral artery in the middle of the thigh, does external hemorrhage always ensue, and if not, what would be your conduct in such a case?

1340. Not always; "a large swelling will (sometimes) immediately form, and the artery will be deeply situated under a large coagulum. A free incision must be made, to give the surgeon ample room to proceed in securing the wounded vessel, a tourniquet being first applied. The direction of the incision will be that required in the operation for popliteal aneurism (1334), only it must be more extensive. The coagulum, which is then exposed, must be scooped out from the wound by the fingers, and the parts be cleanly sponged. The tourniquet is then to be loosened, and the aperture in the vessel will be directly seen, when the tourniquet is to be again tightened, and two ligatures are to be placed around the artery, one above and the other below the wound, an end of each thread being cut off. The edges of the wound are to be approximated, so as to favour the union by adhesion." It is always right in these cases to divide the artery between the ligatures."—*Ibid.*

What mode of treatment would you adopt in a wound of the popliteal artery?

1341. "This vessel is so protected by the condyles of the os femoris, and so concealed behind the bone, that it is rarely lacerated; and when it is so, the wound must be highly dangerous, as it will be, probably, complicated with a division of the sciatic nerve." In tying the artery in the ham, there is some danger of including the sciatic nerve, as it is placed above the artery in cutting into the ham, and it must be carefully avoided: the artery must be drawn from the vein, where the large nerve is placed upon it. Mr. Cline once saw the nerve included in a ligature in the operation for popliteal aneurism, and the patient died in a few hours.—*Ibid.*

In such a case it would probably be better to secure the vessel in the middle third of the thigh.

Are there not wounds of the thigh, which, though they might not have fractured the bone, require primary amputation?

1342. Wounds of the soft parts of the thigh, inflicted either by gun-shot, machinery, or other violent causes, are sometimes so severe as to require immediate amputation.

1st. "If a cannon-shot strike the back part of the thigh, and carry away the muscular part behind, and with it the great sciatic nerve, amputation is necessary, even if the bone be untouched; for although the wound might in some measure heal, the motion of the leg will be lost, and it would become an insupportable burden to the patient."—*Guthrie on Gunshot Wounds.*

2dly. "A cannon-shot destroying the artery and vein on the inside, without injuring the bone, requires amputation." —*Ibid.*

Should the artery and vein be wounded by a musket-ball, or a small canister-shot, without fracture, would you deem amputation necessary?

1343. "When it is sufficiently evident that both vessels are wounded, amputation ought to be performed, or gangrene of the whole limb will soon become apparent. When you know from the hemorrhage that the artery is wounded, but have doubts with regard to the vein being involved in the injury, the artery must be cut down upon and secured at both ends. The vein is now to be examined, and if found entire, the wound is to be closed in the usual manner; but if not, the limb ought to be amputated.

When hemorrhage is pouring from the wound, can you not suggest some method of ascertaining whether the vein is opened, as well as the artery, without cutting down upon the vessels, in order to save the patient this additional pain, in case you may deem it necessary to remove the limb?

1344. If, by the application of the tourniquet, or pressing upon the artery on the pubes, the stream of blood, though not controlled, be changed in colour—that is, from a scarlet to a darker hue, and issue in a steady current instead of a jet, I should fairly conclude that the femoral vein was wounded along with the artery.

When amputation of the thigh is necessary in the upper third of its length, what is the best method of performing it?

1345. Mr. Guthrie recommends the flap-operation, very similar to that performed at the hip-joint; Dr. Hennen, however, has generally adopted the circular incision. It does not appear that the one has any decided advantage over the other, as in either case the bone may be removed from the acetabulum, if, from the nature of the injury, such a step be found necessary.

In amputating high up, at what distance from the upper end of the shaft would you saw the bone?

1346. Even if the integrity of the bone allow of its being left longer, it ought to be sawed off close to the lesser trochanter, lest there follow a troublesome protrusion of the femur, without being of any utility to the patient.—*Guthrie on Gun-shot Wounds.*

Describe the flap-operation at the upper third of the thigh?

1347. The following method is recommended by Mr. Guthrie:—" The patient should be placed in a position nearly horizontal, on a low table, and properly supported. A flannel or calico roller is then to be fastened round the waist, and the inguinal artery compressed against the os pubis. The surgeon, standing on the inside of the left thigh, and the outside of the right, commences his incision through the integuments on the anterior part of the thigh, and carries it down with a gentle curve to the inner and upper part; he then makes the outer incision in the opposite direction, and brings it round underneath to meet the point where the other ceased: these should cut through the fascia, and the whole should be separated from any attachment to the parts beneath with the point of the knife, so as to admit of further retraction by the hands of the assistants. The muscles are then to be divided down to the bone, slanting upwards, in the direction of the first incision, and the femoral artery and profunda secured. The outer and under incisions are then to be made in the same way; the whole is to be separated from the bone, and pressed upwards by common broad pieces of linen, as retractors, assisted by the hands, whilst the bone is sawed through, which is done without difficulty, either from the out or inside, as may be most convenient to the surgeon. The vessels are now to be secured, according to their importance, even to the smallest that bleed: the stump should then be washed with cold water, and well dried; the flaps are to be brought together, and retained by a suture in the middle, and good adhesive straps, the ligatures being brought out above, below, and directly forwards, as their course may point out. Compresses are to be laid upon the sides of the wound, and the whole supported by the bandage brought down for the purpose, but not made to press upon the surface of the stump."—*Ibid.*

When amputation is to be performed on either of the lower thirds of the thigh, what mode of operating ought to be preferred?

1348. In these situations the circular incisions are to be practised.

By what means ought the circulation to be commanded in the operation?

1349. It will be best in this operation to control the circulation by the tourniquet, especially in private practice, where the surgeon will have time at his command. The pad should be placed directly over the artery, and carefully fixed there, either by the bandage in which it is contained, or by the strap of the tourniquet, if the pad be appended to it. Should the pad be contained in a bandage, independent of the tourniquet, the instrument is to be placed directly over the pad; and when the strap is tightened around the limb, and before he takes up the amputating-knife, he ought to assure himself that the strap and buckle are trustworthy, and that the instrument is free to act.—*Guthrie on Gun-shot Wounds.*

In what manner ought the amputating-knife to be held, in order that the integuments and fascia may be divided by one incision?

1350. This is an important point. The handle of the knife should be held by the thumb and fingers low enough towards its end, that in completing the circle around the limb it may play between the index and thumb. By observing this simple rule, the surgeon can never fail of carrying his first incision around the limb in the most easy and accurate manner; whereas in grasping the handle close to the blade, the knife will hardly have liberty enough to effect it by one incision. In this respect I am bold enough to differ from Mr. Guthrie, and in performing the operation I have always experienced the greatest advantage in following this rule.

Describe the operation by circular incisions.

1351. "The patient being placed as before, the assistants are carefully to retract the integuments upwards, and put them on the stretch downwards; by which means their division is more easily and readily accomplished. The surgeon, standing on the outside, passes his hand under the thigh and round above quite to the outside, where he begins his incision with the heel of the knife, and with a quick steady movement carries it round the thigh, until the circular of the skin, cellular membrane, and fascia, is completed. If the fascia should not be completely divided by the first circular incision, it is to be cut with the point of the knife, and at the same time any attachment to the bones or muscles beneath, is to be separated, to allow of its complete retraction; and on the under part, where it is attached to the bone, it will always require this assistance. The amputating-knife is then to be applied close to the retracted fascia and integuments, and the outermost muscles are to be divided by a circular incision, with any portion of the fascia that may not have equally retracted; the edge of the knife, whilst it revolves round the limb, being constantly a little inclined upwards, so as to cut the muscles in an oblique direction. This incision completed, the knife is immediately to be placed close to the edge of the muscular fibres, which are cut through, and the remainder of the soft parts divided to the bone in the same manner." "The muscles attached to the bone are to be then separated, with a scalpel, for about two inches and a half to three inches, in large thighs, by which means the bones will be fairly imbedded when sawed off. The common linen retractor is now to be placed on the limb, and the muscles steadily kept back while the bone is sawn through. The periosteum is to be divided by one circular of the scalpel, after the retractor is put on: the heel of the saw is then to be applied and drawn towards the surgeon, so as to mark the bone, in which furrow he will continue to cut with long and steady strokes, the point of the saw slanting downwards almost in a perpendicular direction, until the bone be nearly divided, when the saw is to be lightly pressed upon, to avoid splintering it, which this manner of sawing will also tend to prevent. During this operation, the thigh should be held steadily above, and in such manner below, that the part to be cut off does not weigh on the bone above; at the same time it must not be pressed inwards or upwards, or it will prevent the motion of the saw, or splinter the bone."—*Guthrie on Gun-shot Wounds.*

Do you see any objection to the muscles being separated from the bone, as originally advised and practised by Mr. Guthrie?

1352. The only objection that can be made is the possibility of an arterybeing wounded, in dividing the muscles, close to the bone, and the difficulty that might occur in securing it. This accident, however, will be so seldom as not to prevent this practice being followed,—a practice highly creditable to Mr. Guthrie, and which has doubtless prevented protrusion of the bone in manifold amputations.

Has any other method of operating been recommended, to obviate protrusion after amputation of the thigh?

1353. Yes. Sir Charles Bell has lately recommended a mode of operating, with a view to prevent protrusion, in preference to that of cutting away the muscle from the bone. He says, "When you have cut the integuments, and your assistant has retracted them, you place the knife close to the retracted integument, and with a sweep carry it down to the bone, and in the entire circle: this makes a uniform surface; but now let the assistant raise the limb up, till the femur comes into a perpendicular position, and then you find the muscles fully retracted, and a large portion of the bone exposed. You now saw the bone horizontally. When you have done, you just see its cut surface, and when the stump is brought down, you see it no longer, and you never ought to see it again; for if you do, it is a bad operation. When the limb is up, the bone perpendicular, and the saw horizontal, the effect of it will be to have no splinter of bone."—*Clinical Lecture on Amputation, in Medical Gazette, Oct.* 18, 1834.

There certainly appears to be great utility in this method, and it is likely to answer the purpose for which it is recommended.

In what manner are the vessels to be secured and the stump dressed?

1354. The retractor having been removed, the femoral artery is to be first secured by means of a tenaculum, and a ligature formed of two strong threads. Any other large artery should be secured in the same way,* together with any arterial branch that may be manifest. The tourniquet may now be slackened, that we may perceive such other smaller vessels that may require the ligature, and these will be best secured by Asalini's tenaculum, or one upon that principle. If the vein continue to bleed, it had better be tied with one thread. If the cancelli of the bone should bleed freely, the thumb of the left hand, pressed steadily upon it, whilst the vessels are tying, will in a short time suppress it. Any inequality of bone may now be removed, and one end of each ligature cut off at the knot. Lastly, the stump is to be washed with cold water and dried; the bandage rolled steadily down the thigh; the muscles and integuments brought forward and placed in apposition horizontally across the face of the stump, and retained by adhesive plaisters, carefully applied from below upwards, and from above downwards.—*Vide Guthrie on Gun-shot Wounds.* The ligatures are to be brought out as straight as possible, and over the plaisters is to be laid a layer of lint, spread with some simple ointment, and the Malta cross, which are to be secured by the end of the roller placed on the thigh. The stump thus dressed is to be a little raised and laid on a pillow.

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* In one instance, after amputation at the middle third of the thigh, I met with an artery (probably a branch of the profunda) quite as large as the superficial femoral, and lying so close to it, that I included both in one strong ligature. The case terminated favourably.

On proceeding to take up the femoral artery, should you unfortunately find the coats of the vessel in a diseased or ossified state, in what manner would you secure it?

1355. By the needle. Mr. Hammick says, that in such a case " it is desirable to include a pretty good cushion of surrounding substance, to prevent its being cut through or yielding, which I have seen it do like a rotten pear; and yet that vessel has been effectually secured by including a good quantity of the surrounding surface."—*Practical Remarks on Amputation.*

Does the use of the needle always require that a considerable portion of the surrounding substance should be included?

1356. On the contrary, when the needle is used to secure an artery, merely because it is beyond the reach of the forceps or tenaculum, as little of the surrounding substance as possible must be included, due care being taken not to wound the vessel itself.

Describe the mode of amputating the thigh at the lower third.

1357. The operation is to be conducted in the same manner as that recommended for the middle third, excepting that, in order to promote the retraction of the integuments, and to prevent their having any ill effect on the vessels of the stump, a longitudinal division, an inch and a half in length, is to be made through the integuments and fascia on each side.—*Guthrie on Gun-shot Wounds.*

State the situations of the femoral artery on the face of the stump in the two last amputations of the thigh.

1358. When amputation has been performed at the middle of the thigh, " the artery will be found on the upper part of the stump, a little above and to the inside of the bone, between the sartorius and triceps muscles; lower down in the thigh it will be on a level with the bone, and about one-third of the distance above the knee it will be on the inside, and rather below the level of the bone."—*Ibid.*

ORDER 2.—*Tibialia.* Emergencies occurring to the knee and leg.

GENUS 1.—*Dislocatio.* Dislocation.

SPECIES 1.—*Dislocatio simplex.* Simple dislocation.

VAR. 1.—*Dislocatio patellæ.* Luxation of the patella.

Of what bones is the joint of the knee formed?

1359. The knee-joint is formed by the femur superiorly, patella anteriorly, and the tibia inferiorly.

By what ligaments are these bones articulated?

1360. The joint is protected and articulated, first, by the capsular ligament, which proceeds from the condyles of the femur, attaches itself to the edge of the patella, and fixes its insertion around the head of the tibia; secondly, by the ligamentum patellæ, which is extended from the lower point of the patella to the tubercle of the tibia. Thirdly, by two external or femoro-fibular ligaments, which pass from the external condyle of the femur to the head of the fibula. Fourthly, by the internal lateral or femoro-tibial ligament, extending from the internal condyle to the head of the tibia. Fifthly, by the oblique or popliteal ligament, by some also called Winslow's ligament, extending from the external condyle of the femur to the posterior part of the head of the tibia. Sixthly, by the crucial ligaments, the anterior of which arises from the inner and back part of the external condyle, and extends obliquely downwards and forwards to a depression in the front part of the spine of the tibia; the posterior from the internal condyle, and, crossing the former, attaches itself to the spine of the tibia, behind the anterior crucial ligament. This joint is also supported superiorly by the rectus, cruralis and vasti muscles, laterally by tendinous expansions, and posteriorly by the popliteus muscle.—*Vide Sir A. Cooper's and Mr. Bransby Cooper's Treatises on this subject.*

In what directions may a dislocation of the patella take place?

1361. This bone may be displaced in three directions, viz. outwards, inwards, and upwards.

What are the marks of the dislocation outwards and inwards?

1362. A large projection upon the external condyle, and an nability to bend the knee, mark the external luxation. The luxation inwards is less frequent. It is immediately known by the displaced patella forming a tumour upon the internal condyle, with the same inability to bend the knee.

Does it follow that the capsular ligament must always be torn by the dislocations?

1363. Sir A. Cooper says, that "in either of these cases the ligament will be torn, unless there be some previous disease;" but this must depend on the extent of the displacement. If the bone be thrown much over the condyle, laceration will of course follow: if it be not so extensively dislocated, laceration does not take place.*

What is the mode of reducing these dislocations?

1364. The limb being extended, and raised by the heel sufficiently high to relax the extensor muscles of the thigh, the displaced bone is to be pushed back into its normal position.

What is the cause of the displacement of the patella upwards?

1365. The rupture of the ligamentum patellæ; the immediate effect of which is the drawing of the patella upwards by the action of the rectus femoris muscle.

What are the diagnostic marks of this accident?

1366. The elevation of the patella upwards; its easy motion from side to side; a deep impression above the head of the tibia, from the absence of the ligamentum patellæ, and an impossibility of bearing upon or extending the limb.

What is the treatment of this severe injury?

1367. "In the treatment of this injury, local depletion and evaporating lotions are to be used, during five or seven days from its occurrence, and then a roller is to be applied around the foot and upon the leg, to prevent its swelling; the leg is to be kept extended by a splint behind the knee, and a bandage, composed of a leathern strap, is to be buckled round the lower part of the thigh; to this is to be attached another, which is to be carried on each side of the leg, and under the foot, and is to be buckled to the circular strap; thus the bone is gradually drawn down, so as to allow of an union of the ligament. In a month the knee may be slightly bent, and as much passive motion daily given as the patient is able to bear; by these means the ruptured ligament becomes united, and the patella retains its motion. During the time the bandage is worn, the patient is to preserve the sitting posture, in order to relax the rectus muscle, and to prevent its action upon the patella."—*Sir A. Cooper's Treatise on Dislocations, &c.*

Do you acknowledge a dislocation of the patellæ downwards?

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* Sir R. R. fell from his horse, and dislocated the patella upon the outer condyle. After it was reduced, no disturbance or swelling of the joint followed, and in a very few days he was enabled to take his usual exercise without inconvenience.

1368. There can hardly be such a case. Into what displacement can the bone be drawn in this direction, and by what means can the bone be drawn into it? This supposed case occurs when the tendon of the rectus femoris is ruptured; an accident which sometimes happens, but no material displacement of the patella follows.—*Ibid.*

What treatment would such an injury require?

1369. The patient is to be placed in a sitting posture; a cushion is to be applied upon the ligamentum patellæ, and confined there by a roller passed round the head of the tibia. —*Ibid.*

Var. 2.—*Dislocatio tibiæ capitis.* Dislocation of the head of the tibia.

In what directions may the tibia be luxated?

1370. The tibia may be dislocated in four directions; outwards, inwards, forwards, and backwards.

What are the appearances of the displacement outwards?

1371. This luxation is generally incomplete; nevertheless the deformity is considerable. "The tibia projects upon the outer part of the joint, the internal condyle upon the inner side, and the external condyle rests upon the internal semilunar cartilage."—*Sir A. Cooper's Lectures, by Tyrrell.*

State the appearance of the luxation inwards.

1372. The head of the tibia projects inwards, the external condyle of the femur outwards; whilst the internal condyle rests upon the external semilunar cartilage. This luxation is also incomplete.

What would be your method of reduction?

1373. "The reduction in either instance may be readily effected by direct extension." The bones are to be kept in their normal position by splints and a wet bandage.

What are the signs of the dislocation of the tibia forwards?

1374. In the recumbent position "the head of the tibia projects forwards, and the inferior part of the thigh-bone is depressed, being thrown a little to one side as well as backward; the patella is drawn up by the action of the rectus muscle. The circulation through the popliteal vessels is obstructed by the pressure of the femur posteriorly, so that the arteries below cease to pulsate, and the foot feels numbed from pressure upon the nerves."—*Ibid.*

State the signs of the posterior luxation of the tibia.

1375. In this case there will be "a projection of the condyles of the os femoris anteriorly, a depression of the ligamentum patellæ, the head of the tibia is seated behind the condyles, and the limb is shortened, the leg being bent forwards."—*Ibid.*

Mr. Professor Cooper, however, doubts the accuracy of this statement, as it respects the position of the leg, and conceives it to be a mistake, especially as Boyer declares, "that in the dislocation of the head of the tibia backwards, the leg is bent to a very acute angle, and cannot be extended again."—*Dictionary of Practical Surgery.*

When this kind of dislocation is complete, what extent of injury takes place in the soft parts?

1376. Such a degree of displacement would cause laceration of the popliteus muscle, the ligamentum Winslowi, capsular and crucial ligaments, and in all probability rupture of the ligamentum patellæ or the tendon of the rectus femoris.

In what manner are these dislocations, forwards and backwards, to be reduced?

1377. The dislocation of the tibia forwards is easily reduced by extending the thigh from above the knee, and by drawing the leg from the thigh, inclining the tibia a little downwards."—*Sir A. Cooper's Lectures, by Tyrrell.*

The complete dislocation backwards may be reduced in the manner practised by Dr. Walsham, in a case of this kind, where the tendon of the rectus femoris was ruptured. It was effected as follows:—"Two men extended upwards, one from the groin, another from the axilla, whilst two others extended the leg from a little above the ankle in the opposite direction; and they gradually increased the force of their extension, till the bone was reduced. At the time of extension, Dr. Walsham directed the head of the bone to its natural situation. A roller was afterwards placed over the knee, and the limb was laid upon a pillow, and an evaporating lotion was constantly applied."—*Ibid.*

Might not the femur be sometimes partially dislocated from the semilunar cartilages, and from what cause?

1378. Such a dislocation might, and does occur, to persons in whom the ligaments of the semilunar cartilages are in a relaxed state, so as to allow the condyles to push the cartilages from their situation, and to come in contact with the head of the tibia. Under such circumstances, when an attempt is made to extend the limb, the edges of the semilunar cartilages prevent it. The nature of this accident was first explained by the late celebrated Mr. Hey, of Leeds.

In what manner is this partial luxation to be remedied?

1379. The limb is to be bent as much as possible, that the cartilage may be at liberty to slip into its proper position. After this the limb is to be again extended, that the condyles may fall back upon the cartilage. This is a simple mode of treatment practised by Mr. Hey, and generally succeeds.

VAR. 3.—*Dislocatio capitis fibulæ.* Luxation of the head of the fibula.

By what means is the fibula joined to the tibia?

1380. The head of the fibula is joined to the tibia by the capsular, and the greater part of its length by the interosseous ligament; its connexion is also strengthened by the various muscles situated betwixt it and the tibia.

What are the signs of a dislocation of the head of the fibula, and what treatment would such displacement require?

1381. When the head of the fibula is forced from its connexion into the tibia, the nature of the injury may be discovered by the shaft of the bone lying out of its collateral position with the tibia, and by a difficulty to raise or move the foot outwards. The primary treatment will be to reduce the dislocation, and to confine the bone *in situ* by wet compress and bandage.

SPECIES 2.—*Dislocatio genu composita.* Compound dislocation of the knee-joint.

What are the local symptoms of compound dislocation of the knee?

1382. Dislocation of the tibia in any of the four directions mentioned above, complicated with an external wound opening into the joint, through which the bone may or may not protrude.

What primary treatment does such a case require?

1383. Should the wound into the joint be extensive, or the luxation be aggravated by fracture, amputation ought immediately to be performed.—*Sir A. Cooper.*—*Liston.* But "should a case of compound dislocation of the knee occur, in which a very small wound only existed, admitting of ready closure, it would be right to attempt the preservation of the limb."—*Sir A. Cooper's Lectures, by Tyrrell.*

GENUS 2.—*Fractura.* Fracture.

SPECIES 1.—*Fractura simplex.* Simple fracture.

VAR. 1.—*Fractura simplex articulationis.* Simple fracture of the knee-joint.

What are the characteristic marks of a fracture of the condyles of the femur into the joint?

1384. This case will be known by swelling of the joint and by crepitation upon moving the joint generally, and by the moveableness of the condyle suspected to be fractured.

What mode of treatment is required for a fracture of this kind?

1385. "Whether the external or internal condyle be broken, the same treatment is required. The limb is to be placed upon a pillow in the straight position, and evaporating lotions and leeches are to be used to subdue the swelling and inflammation. When this object has been effected, a roller is to be applied around the knee, and a piece of stiff pasteboard, about sixteen inches long, and sufficiently wide to extend entirely under the joint, and to pass on each side of it, so as to reach to the end of the patella, is to be dipped in warm water, applied under the knee, and confined by a roller. When this is dry, it will have exactly adapted itself to the form of the joint, and this form it will afterwards retain, so as best to confine the bones."—*Sir A. Cooper's Treatise on Dislocations, &c.*

Why do you prefer the straight position in this fracture?

1386. "Because the tibia presses the extremity of the broken condyle into a line with that which is not injured."—*Ibid.*

In what directions is the patella most commonly fractured?

1387. The patella is most commonly fractured transversely; but sometimes, though unfrequently, in a longitudinal direction.

What is the immediate effect upon the patella after the occurrence of this accident?

1388. The upper portion of the bone is immediately drawn up, and separated from the lower, by the action of the rectus femoris, cruralis, and vasti muscles, leaving an interspace of "from half an inch to five inches;" the length of that space dependent upon the degree of laceration of the capsular ligament and tendinous aponeurosis covering the bone.

What are the diagnostic marks of this fracture?

1389. The separation of the patella, and our being able to press down the integuments upon the condyles of the femur between the fractured portions; by the free lateral motion of the upper portion, and by the inability of the patient to extend the limb, or support himself upon it.

What are the next set of local symptoms that follow upon the accident?

1390. "A few hours after the receipt of the accident, the part becomes tumid from extravasation of blood, and the surface presents a discoloured appearance from ecchymosis; this, however, subsides in a few days, but the joint enlarges from an increased secretion of synovia, and from effusion in consequence of inflammation."—*Sir A. Cooper's Lectures, by Tyrrell.* This injury is not accompanied with much pain or constitutional disorder.

What is the treatment of transverse fracture of the patella?

1391. The first thing to be arranged is the position of the limb. The patient is to be laid on a mattress, and the injured extremity extended and placed on a well-padded hollow splint, long enough to reach from the middle of the thigh to the lower part of the calf of the leg. The heel should be raised, and the trunk somewhat elevated, in order to relax the extensor muscles of the thigh, and prevent the upper portion of the patella from being drawn upwards. The limb should be lightly bandaged to the splint, and the joint enveloped in compresses wet with evaporating lotion. Leeches also should be applied, if indicated by pain or tension.—*Ibid.*

What treatment will be required to approximate and unite the broken portions of the patella?

1392. As soon as the tension has subsided, and not on any account before, "a roller is to be applied from the toes to the knee, to prevent swelling of the leg; two pieces of broad tape (or of a common roller) are then placed on each side of the patella, in the direction of the limb, and two rollers are next bound round the extremity, one above, and the other below the knee-joint, confining the pieces of tape and having the two portions of bone betwixt them: the ends of the tape on each side are afterwards turned over the rollers, and tied so as to bring the rollers nearer to each other, and thus press the portions of the fractured bone as nearly as possible together; the splint is again applied and fixed to the limb, to prevent any flexion of the joint; the heel is still raised, and the body supported nearly in the sitting posture."—*Ibid.*

By what diagnostic marks could you discover a perpendicular fracture of the patella?

1393. By the separation of the bone into two lateral portions; for although there will not be so extensive an interspace as in the transverse fracture, there will be sufficient to enable us to detect the nature of the case. If there should be not much separation, there will be crepitation. It may also be suspected, by an inability to extend or bear upon the limb.

In what manner would you treat this fracture?

1394. The treatment of this accident consists in placing the limb in an extended position, with a padded splint posteriorly, to prevent any motion of the knee-joint; and in applying an evaporating lotion, until the swelling and pain have subsided; after which, a knee-cap, padded on each side of the patella, should be buckled around the joint, the straps passing above and below the patella.—*Ibid.*

It appears to me, that the bones may be kept in closer apposition by means of adhesive plaister spread on strips of leather, which should be applied around three-fourths of the circumference of the joint, beginning beneath the hamstrings, carrying them up in opposite directions, and crossing them upon the patella. Before the superior ends are laid down, extension should be made with them, in order to bring the fracture in as close union as possible.

What kind of union is generally effected in fractures of the patella?

1395. In both cases ligamentous union is usually the result; but if it be possible to keep the broken edges of the bone in accurate contact, ossific union may be, and has been, effected.

What are the signs of the head of the tibia being broken obliquely into the joint?

1396. This fracture can be discovered by crepitation on moving the joint, by the fractured portion being moveable, and by the capsular ligament being more or less distended by the synovial fluid.

In what manner would you treat this fracture?

1397. The limb is to be placed in the extended position, "in which the extremity of the thigh-bone tends to keep the fractured bone in its proper situation." There must also be the application of a piece of wetted pasteboard and a bandage, as recommended for oblique fracture of the condyles of the femur.—*Vide* 1385.

Should there be oblique fracture of the head of the tibia, yet not extending into the joint, what ought to be the position of the limb?

1398. "The semiflexed position of the limb over a double-inclined plane will be best, as the weight of the leg then counteracts the efforts of the muscles, which would otherwise draw up the inferior portion of the broken bone."—*Sir A. Cooper's Lectures, by Tyrrell.*

VAR. 2.—*Fractura columnæ ossium.* Fracture of the shaft of the bones.

What are the kinds of simple fracture usually met with in the shafts of these bones?

1399. "Fracture," says Mr. Liston, "may occur at any part of the leg. One or both bones may give way, either transversely or obliquely, according to the application of the force. The transverse fracture is produced by a direct blow, by a heavy body striking or falling on the limb, or by the lower part of the limb being fixed, whilst the body is in rapid motion. The oblique is caused by force applied in the direction of the bones, as when a person falls or leaps from a height, and alights on one foot, the limb being extended and the body erect.—*Elements of Surgery.*

When both bones are broken, does it follow that they shall be broken at the same point?

1400. Not always; for in an oblique fracture the tibia may be fractured a few inches from its lower extremity, and the fibula may be found broken at a short distance from its upper extremity,—both giving way at their weakest points, from the force having been received at the ends of the bones.

Might there not be considerable difficulty in accurately ascertaining such a fracture?

1401. It might escape detection by a careless practitioner; but an attentive surgeon will never suffer such an injury to pass unexplored for the want of due manipulation.

What are the appearances of the limb when the tibia is fractured at its upper end, but below the tuberosity?

1402. There will be considerable displacement, particularly in the bent position of the knee, from protrusion of the upper end of the tibia, occasioned by the action of the extensor muscles.—*Liston's Elements of Surgery.*

Is there much deformity when one bone is broken lower down in the limb?

1403. In this kind of fracture there will not be much displacement. Indeed, attentive manipulation is often required to detect the site of the injury; and a sense of crepitation is perceived only when the lower and upper portions of the bone are pressed on alternately, or during rotation of the foot.—*Ibid.*

What are the appearances when both bones are fractured at the same point?

1404. There will be generally great deformity and tumefaction. The toe will be in the majority of cases turned outwards, and when the soft parts are contused or lacerated, although the integuments be entire, the lower end of the fractured bone will hang quite loose.—*Ibid.*

What is the most frequent cause of fracture of the fibula, and at what part of the bone does fracture most commonly occur?

1405. The fibula is generally fractured by the ankle being pressed forcibly inwards and the foot outwards, by which the ankle is partially dislocated inwards, and the fibula, almost always, broken about two or three inches above the external malleolus. This is the most frequent fracture to which the fibula is liable, and constitutes what is commonly called "Pott's fracture."

What are the characteristic marks of this fracture?

1406. The peculiar appearance of the limb, occasioned by the projection of the internal malleolus, and the indentaton above the outer ankle,—the first, marking the partial dislocation of the lower end of the tibia, and the second, the point of fracture of the fibula, whose broken ends are bent inwards.

Is it not important that due examination of the injury should take place as soon as possible after its occurrence, with a view to detect its real nature?

1407. This is very important; otherwise an injury, which at first may have been easily and accurately detected, will be so masked by tumefaction and inflammation as to render the discovery much more difficult, especially if one of the bones only be fractured.

What would be your treatment of a fracture at the upper end of the shaft of the tibia?

1408. Fracture of the upper part of the tibia, below its tubercle, should be placed in the straight position, to prevent projection of the upper portion by the action of the rectus femoris muscle. Mr. Liston advises that a hollowed splint of wood, extending from the middle of the thigh to near the heel, be applied behind, whilst one of pasteboard is placed on each side, and that all be secured by bandaging, the foot and lower part of the limb being rolled previously, to prevent infiltration: by this simple apparatus, motion of the knee-joint, and of the ends of the bones on each other, is completely prevented; the heel is raised, if necessary, for complete adaptation.—*Elements of Surgery.*

Describe the treatment of fracture of the shaft of both bones.

1409. "Fractures of the middle and lower portions of the bones," says Mr. Liston, "are treated more advantageously in the bent position, the angle being made more or less obtuse according to the degree of flexion most conducive to easy reduction and retention. Extension is made on the limb, and the parts brought into as natural and handsome a shape as possible; and in so doing, the appearance of the sound member should be kept in view. There is seldom any difficulty in accomplishing reduction; the extending and counter-extending power need be but slight: the upper part of the limb is steadied by an assistant, whilst the lower is stretched and moulded by the hands of the surgeon." The splint is the same as that recommended, when treating of fractured thigh, composed of a thigh and leg-piece, with a moveable foot-board—the double-inclined plane, improved by Mr. M'Intyre, of Newcastle, and others. The foot-board is fixed so as to make the leg-piece of the proper length, and the splint is secured at a convenient angle. It is padded by means of a cushion filled with fine chaff. The foot is rolled separately; the limb is then raised carefully, and laid down on the splint, placed quickly beneath by an assistant; it is retained in a proper position by the hands of the surgeon, whilst a roller is carried from the toes round the foot-board and along the limb to the knee. A broad roller is then made to surround the thigh and splint, and having been turned several times round the loins, is secured to the upper part of the cushion."—*Elements of Surgery.*

Mr. Amesbury has invented an excellent apparatus for this kind of fracture, very much upon the same principle. I have lately seen two fractures of the leg—one a simple oblique, and the other a compound fracture—treated with Mr. Amesbury's apparatus, by Mr. Judd, of this town, both of which have terminated most creditably to this mode of treatment.

Are not fractures of this part of the leg sometimes placed in the straight position?

1410. This position was warmly advocated by the celebrated John Hunter, and as warmly disputed by Mr. Pott, who contended for the superiority of the bent position. Each of these positions has, therefore, for a long time been practised by the respective followers of these great masters; but I believe the general opinion is decidedly in favour of the flexed position, and that upon the double-inclined plane.

But as it rarely happens, especially in country practice, that either Mr. M'Intyre's or Mr. Amesbury's splint will be at hand, what means could be substituted?

1411. A very practical imitation could be, with but little delay, formed out of a few pieces of deal, by any village carpenter, under the direction of the surgeon; and such, properly padded by tow and compresses, would answer every primary purpose. If such means cannot be accomplished, the limb must be laid in the bent position, on the many-tailed bandage, Sharp's splint and pillow, and bandaged and supported in the usual way. The great toe is to be kept in a line with the patella.

What would be your treatment of a fracture at the lower end of the fibula, associated with partial dislocation of the inner ankle?

1412. The treatment of this fracture will be given under the article " Simple dislocation of the malleolus internus."—*Vide* 1471.

SPECIES 2.—*Fractura composita.* Compound fracture.

VAR. 1.—*Fractura articulationis genu composita.* Compound fracture of the knee-joint.

What would be your treatment of a compound fracture of the patella?

1413. " When this accident is attended with extensive laceration and much contusion of the surrounding soft parts, it will be right immediately to amputate the limb; but should the wound be small, so that its edges can be readily approximated, and not accompanied with such mischief as is likely to occasion sloughing, an attempt should be made to preserve the extremity."—*Sir A. Cooper's Lectures, by Tyrrell.*

What is the principal indication of cure in the preservative mode of treatment?

1414. Our primary object will be the union of the external wound, and with this view sutures must be made use of to keep the edges of the wound in close and accurate contact, as well to prevent the transmission of the proper fluid of the joint, which, but for the sutures, would probably occur, and frustrate our endeavours to effect union by the first intention.

It will be requisite also to apply strips of adhesive plaisters over the sutures; and the heat of the part should be evaporated by cold lotion, applied by means of linen compresses and a bandage, lightly carried around the joint. The necessity of the straight position and positive rest is sufficiently obvious.

Do you not consider poultices and fomentations very objectionable as a primary treatment of this injury?

1415. Sir A. Cooper objects to these relaxing applications, as tending to prevent union of the wound; and Mr. Hammick recommends pieces of lint, dipped in a strong solution of gum-arabic, to be laid over the strips of adhesive plaister, in order to prevent even the lotions from coming in contact with the wound.

State the primary treatment of compound fracture of the condyles of the femur or head of the tibia, extending into the joint.

1416. In the primary treatment of these most serious accidents, our conduct must be guided by two circumstances; first, by the nature of the external wound, and secondly, by the nature of the fracture; for as an extensive, lacerated, and contused wound into the joint, without scarcely any reference to the degree of fracture, would require immediate amputation of the thigh, so would a comminuted state of the condyles of the femur or head of the tibia, with a very small wound opening into the joint, equally require the operation. If, however, the bone should not be comminuted nor broken into pieces, and if, at the same time, the external wound be more of an incised than lacerated character, and can be brought into accurate replacement, an attempt may be made to save the limb by the treatment laid down at 1414, for compound fracture of the patella.

You there state the use of the suture: is not great caution necessary in their application in this particular case?

1417. Undoubtedly. He must be most cautious not to run them through the synovial or fascial tissues.

What treatment is required when compound fracture of the knee-joint has been produced by a musket-ball?

1418. "It is almost unnecessary to state, that the relief for wounds of this kind is to be obtained by amputating the limb; and from an extensive practice in wounds of the knee-joint, with fracture of the articulating surface of the femur or tibia," Mr. Guthrie "has no hesitation in declaring amputation to be imperiously demanded, and that it ought to be performed with the least possible delay, consistent with propriety."

Is there no exception to this rule?

1419. This is a rule that admits of no exception; compound fractures of the knee-joint by musket-shot invariably demand immediate amputation.

Suppose a ball should lodge either in the head of the tibia or condyles of the femur, within the capsular ligament, what treatment would be required?

1420. If a ball have found its way into this situation, and cannot be easily extracted, Mr. Guthrie advises amputation, for the limb, if preserved, will not be a useful one. But, he says, "if the ball lodge without the capsular ligament, and cannot easily be extracted, the wound should be healed as soon as possible; and although it may cause some little inconvenience to the knee-joint, it will preserve the limb and life of the patient, as I have seen in many instances; when a continuance of persevering efforts to extract it would have exposed both to great hazard."

VAR. 2.—*Fractura columnæ ossium composita.* Compound fracture of the shaft of the bones.

What treatment is required for a compound fracture of both bones of the leg, unaccompanied by comminution of the bones, or extensive injury of the soft parts?

1421. Should the upper portion of the tibia protrude through the integuments, our first step will be to extend the limb, in order to reduce and replace it to its natural position; but should this, from the narrowness of the opening, or whatever cause, be found impracticable, "either the portion must be abridged by the saw or cutting pliers, or the wound must be enlarged. Sometimes the one mode is preferable, sometimes the other; occasionally both are required. When the protruding portion composes but a small portion of the shaft, though perhaps of considerable length, it should be taken away; but when, on the contrary, it is more thick than long, it is better to enlarge the wound; but on this subject no general rules can be laid down."—*Liston's Elements of Surgery.* As soon as the fracture is reduced, the wound is to be accurately closed by strips of adhesive plaister; but in doing this we must be careful not to use too much force in bringing the edges together, lest their vitality be destroyed, and sloughing ensue. The limb is then to be laid upon a double-inclined plane, and treated in the manner advised for simple fracture.—*Vide* 1409.

Are not vesications a frequent result almost immediatety after the accident, and if so, what treatment would they require?

1422. Vesications are not unfrequently observed after violent injuries of this kind, and the only requisite treatment will be, that they be covered in by compresses, wrung out with spirit lotion.

Should the integuments be extensively torn up in front, and so displaced as not to admit of their being brought again into their natural position, the bones being at the same time fractured into several fragments, what ought to be the primary treatment?

1423. Such a case would not require the primary operation of amputation. Spiculæ and loose portions of bone should be removed; the displaced integuments approximated by adhesive plaister, lightly applied, and by linen compresses wetted with spirit lotion, and the case treated in the usual way.—*Vide* 1409.

Should the fibula be broken, and a considerable portion of it carried away, with extensive injury of the soft parts, what would be your conduct?

1424. Such an injury does not require priminary amputation, and therefore justifies the preservative treatment.—*Guthrie on Gun-shot Wounds.*

What treatment would be required, where the tibia alone is fractured by a musket-shot?

1425. In a case of this kind, so much support is afforded by the fibula, and such is the advantage of the superficial position of the tibia, that considerable fractures of the bone from musket-balls may be treated successfully, "the danger being greatest in the vicinity of the joints of the knee and ankle."—*Ibid.*

Should such a fracture of the tibia be complicated with a wound of the anterior or posterior tibial artery, what would be your decision as to the primary treatment?

1426. "A fracture of the tibia alone, with a wound of the anterior or posterior tibial artery by the same ball, does not authorize amputation, except the limb be stuffed with blood, and the incisions necessary to secure both ends of the bleeding vessel, leave, in addition to the fracture, so great an extent of injury, that there be little or no probability of success."—*Ibid.*

Should both bones be fractured, and only the anterior tibial artery wounded, would you attempt to preserve the limb or amputate it?

1427. Such an injury would justify an attempt to save the limb.—*Ibid.*

If a musket-ball pass through the upper end of the tibia below the tubercle, and fracture the articulation of the head of the fibula, allowing the bones to grate immediately below the knee, what ought to be the primary treatment?

1428. This is a very dangerous injury, and in elderly men, who have drank hard, or have been free livers, with bad constitutions, or who have been many years in tropical climates, Mr. Guthrie recommends immediate amputation, lest death may ensue from irritation; but in young and healthy persons, he authorizes an attempt to save the limb by the strictest antiphlogistic regimen, deferring the amputation till such a mode of treatment shall prove unavailing.—*Ibid.*

State those cases of compound fracture of the shaft of the bones that absolutely require immediate amputation.

1429. 1st. If both bones be comminuted, with extensive contusion and laceration of the soft parts, from whatsoever cause the accident shall have proceeded, immediate amputation will be necessary.

2dly. When the leg has been carried away by a cannon-shot, immediate amputation will be of course required.

3dly. "When both bones are seriously fractured with a wounded posterior tibial artery, that cannot be secured on moderate search, or the limb be injected with blood, amputation is the best remedy to prevent further evil."—*Guthrie on Gun-shot Wounds.*

4thly. "If the tibia and fibula be broken in two places by two distinct musket-balls, which have passed through the leg, it will, I believe, be better to amputate; for although it might be saved (and I have saved limbs under an injury of this kind), it would be a useless, inconvenient member, which the patient, after some months of pain and inconvenience, would most readily part with."—*Ibid.*

5thly. If a piece of shell strike, and extensively lacerate, the calf of the leg, at the same time fracturing the tibia, immediate amputation is required.—*Ibid.*

Species 3.—*Vulnus proprium tibiale.* Wound occurring to the leg.

What are the principal arteries of the leg?

1430. The posterior tibial, the anterior tibial, and the peroneal arteries.

Describe the course of the posterior tibial artery.

1431. This vessel may be regarded as the continuation of the popliteal artery. It commences at the lower border of the popliteus muscle, and terminates below the inner ankle in its division into the plantar arteries. "The course of the vessel is obliquely downwards and inwards, being placed above, midway between the bones of the leg, and below between the inner ankle and the prominence of the heel."—*Quain's Elements of Anatomy.*

What is the relative position of this artery?

1432. "Its anterior surface," according to Dr. Quain, "rests successively on the tibialis posticus, the flexor longus digitorum, and inferiorly, for about two inches, on the tibia, separated from it by some cellular tissue; posteriorly it is covered by the gastrocnemius and soleus, (the deep fascia being interposed) and further down by the fascia of the leg, as it is stretched from the tendo achillis to the border of the tibia. On each side lie its accompanying veins, and along its external or fibular side runs the posterior fibular nerve. It will be recollected that in the hollow, between the internal malleolus and calcaneum, run three tendons, as well as the posterior tibial vessels. Their relative position may be stated as follows: the tibialis posticus and flexor longus digitorum run close to the inner malleolus; a quarter of an inch behind these is the tibial artery, the nerve being a little posterior to it, and finally, about half an inch further backwards towards the heel, is the tendon of the flexor longus pollicis."—*Ibid.*

Describe the course and relative position of the peroneal artery.

1433. This vessel takes its origin from the posterior tibial, and runs down the posterior part of the leg in the direction of the fibula. Hence it has been called by some the fibular artery. It commences from about an inch to two inches below the lower border of the popliteus muscle, and descends almost perpendicularly towards the external ankle. Running for a while parallel, and on the same plane with the posterior tibial artery, it lies on the tibialis posticus muscle, and is covered for the same distance by the soleus; as it descends, it inclines outwards to the fibula, and corresponds with the angle of union between it and the interosseous ligament. In this part of its course it is concealed from view by the flexor longus pollicis." "On reaching the lower extremity of the interosseous ligament, which is about two inches or a little more above the external ankle, the artery usually divides into two branches, named, from their situation, anterior and posterior peroneal."—*Ibid.*

What is the course and relative situation of the anterior tibial artery?

1434. Its course may be marked out by a line drawn from the inner border of the head of the fibula to the middle of the ankle-joint. It arises from the popliteal artery, and immediately turns horizontally forwards to reach the anterior surface of the interosseous ligament. In doing so, it necessarily passes between the heads of the tibialis posticus muscle, and through the interval between the bones left unclosed by that membrane. In its course it rests for two-thirds of its extent on the interosseous ligament, and for the rest on the anterior surface of the tibia. In the upper part it is deeply seated, and in a manner overlapped by the tibialis anticus and extensor longus digitorum, the former being on its tibial, and the latter on its fibular side. Lower down, it lies between the extensor pollicis and tibialis anticus, and ultimately passes beneath the extensor pollicis, and is placed between the tendon of this muscle and that of the extensor communis digitorum. The anterior tibial is accompanied by two veins; the anterior tibial nerve lies to its fibular side for some way, as being derived from the peroneal nerve, but usually inclines in front of it, as it descends.—*Vide ibid.*

State the mode of cutting down upon the posterior tibial artery in a wound of that vessel.

1435. When hemorrhage takes place from a wound of this artery, the tourniquet is first to be applied above the knee, at the usual point of the thigh. " Then place the limb in a bent position, so as to relax the gastrocnemius muscle, which I should raise from its attachment to the tibia, so as to expose the artery and its accompanying nerve, which I should be careful to exclude, whilst I put two ligatures upon the wounded vessel, and afterwards should carefully close the wound, and unite by adhesion."—*Sir A. Cooper's Lectures, by Tyrrell.* After having detached the gastrocnemius and soleus from the tibia, we shall find the aponeurosis, which separates these from the deep-seated muscles, and beneath this aponeurosis the artery will be found.

Should this vessel be wounded at the upper part of the leg, close to the origin of the anterior tibial, what would be your conduct?

1436 A ligature ought to be put round the femoral artery, at the usual place; and if this did not stop the hemorrhage, the thigh must be amputated, as the safest course to pursue. Sir A. Cooper authorises this treatment.

State the mode of securing it at the lower part of the leg.

1437. Here " the artery is easily found and secured behind the malleolus internus; it is accompanied by the posterior tibial nerve, which lies on its fibular side, and must be avoided."—*Ibid.*

" The artery runs a little nearer the heel than the tendons of the flexor communis; a fascia braces down the artery, and the nerve is under the artery."—*Bell's Operative Surgery.*

Should the peroneal artery be wounded, in what direction would you make your incision, in order to secure it by ligature?

1438. " I should cut upon the vessel from the outer part of the leg, and seek it between the tibia and fibula, close to the fibula."—*Sir A. Cooper's Lectures, by Tyrrell.*

To find this artery two hands' breadth from the heel, cut betwixt the gastrocnemius and peroneus longus, *i. e.* on the outside of the gastrocnemius, where it is becoming tendinous; turn up the edge of the tendon; you then find the flexor pollicis covered with its sheath. If you seek for the fibular artery, by going deep in the leg without piercing this sheath, you find the tibial nerve, and may come on the tibial artery. To find the fibular, then, you cut down by the side of the fibula, and raise the fibrous origin of the flexor pollicis. We then find the artery by the acute edge of the bone, lying on the interosseous ligament, accompanied only by its venæ comites.—*Bell's Operative Surgery.*

Should the anterior tibial artery be wounded at its upper part, describe the manner of cutting down upon it, to tie it.

1439. " When wounded at the upper part of the limb, an incision must be made at the outer side of the tibialis anticus, to find it: a tenaculum or a pair of forceps must be employed to raise the wounded artery, to remove it from the interosseous ligament, and then two ligatures are to be applied upon it."—*Sir A. Cooper's Lectures, by Tyrrell.*

Describe the method of tying it at the lower end of the anterior part of the leg.

1440. " When the anterior tibial artery is wounded low down in the leg, it must, when it is tied, be completely raised from the tendons of the tibialis anticus and extensor proprius pollicis, between which it is placed; both ends must be secured."—*Ibid.*

Is there any wound of the soft parts of the leg, unaccompanied by fracture of the bones, that would require immediate amputation?

1441. The following case, according to the authority of Mr. Guthrie, would require the primary operation.

If the calf of the leg be wholly or in part torn away, and "if, in addition to the injury of the soft parts, the tibialis postica and peroneal arteries be divided, amputation should be performed, and the knee-joint preserved, which might by delay be implicated in the disease."—*On Gun-shot Wounds.*

At what points of the shaft of the bones is amputation usually performed?

1442. It has been usually performed at about four inches from the patella, or two inches and a half from the tubercle of the tibia, (though, if necessary, the tibia may be sawn off close to its tuberosity,) and sometimes lower down, by the flap operation.

Describe the mode of operating through the calf by the usual circular incisions; but in the first place state the preliminary steps necessary to be arranged for the operation.

1443. The tourniquet having been applied at about one-third the length of the thigh from the knee, the patient is to be placed "on a table of a suitable height, and if he be greatly exhausted, allow him to lay back on blankets, with the shoulders a little raised; or, if he should prefer it, he may be permitted to sit up, leaning his back against the breast of an assistant; in either way, about four inches of the lower part of the thigh should be beyond the edge of the table: the lower part of the limb is to be given in charge to an assistant, who, sitting on a stool in front, is to hold it so that he may bring, if possible, the foot on a level with the knee; but this can scarcely ever happen, excepting in recent accidents, from the contracted state of the ham by the flexors tendons of the leg: if we cannot do it to the full extent, we must be satisfied with it as far as we can: another assistant, standing on the inner side of the thigh, and leaning forward so as not to be in the way of the operator, takes strong hold, with one hand on each side of the calf, of the integuments of the leg about four inches below the tubercle of the tibia, so that the knee also may be steadied by his wrists," whilst he is pulling up the integuments. The surgeon (supposing the right leg is to be amputated) stands on the outside.—*Hammick's Practical Remarks.*

In the second place, describe the mode of amputating the limb.

1444. The assistant pulling up the integuments so as to put them upon the stretch, "the surgeon makes, with a full-sized amputating knife, a circular incision through the integuments only: the circle being finished, he dissects with the point of the same knife the integuments from the tibia, so as to free them for an inch or more, adapting it to the muscularity of the patient, tucking them upwards without entirely rolling them back; then with the knife applied close to the edges, which will be about an inch from where they were first forced up from the muscles, he should make a bold stroke, so as to divide the muscles all around down close to the bone, and after freeing them a little more from the outer side of the fibula, a catlin is to be passed between the bones at the uppermost part, corresponding with the circular detachment: the bones being liberated from the muscles, a retractor is to be thrust in between the tibia and the fibula, and drawn forcibly upwards in such a way as to protect the integuments and muscular parts from the saw. The knee is to be turned inwards, with the view of sawing through the fibula first, about half an inch shorter than the tibia. As soon as this bone is divided, which two or three movements of the saw will effect, the leg is to be placed with the tibia fairly uppermost, so that it may be sawn half an inch lower than the fibula, which ought to be as close as possible to the edge of the turned back integuments, and where the periosteum must have been previously divided. The limb being removed, the muscles and coverings are brought forwards, to ascertain the nature of the stump, and after again exposing the surface, the arteries are to be secured."—*Ibid.*

How many arteries ought to be secured before the tourniquet is slackened?

1445. The anterior tibial, which will be found betwixt the tibia and fibula upon the interosseous ligament, the posterior tibial behind the tibia, and the peroneal artery behind the fibula. After these have been secured, the tourniquet may be loosened, when the surales and any other smaller vessels may be tied.

In what manner would you dress the stump?

1446. "The tourniquet being removed, the smaller vessels tied, and the stump washed with cold water and dried, the integuments and muscles should be brought forward as much as possible, and the straps of adhesive plaister applied from side to side; that is, the wound is to be closed vertically, or nearly so, that the straps of plaister may not in any way press upon the fore part of the tibia, by which the protrusion of it will be avoided; an occurrence which, Mr. Guthrie observes, almost immediately follows in military practice, when the line of approximation is horizontal, and the straps of plaister press upon the bone; and although this method of closing the wound is recommended by gentlemen of authority in the profession, I am satisfied it is very unsafe in military surgery.—*On Gun-shot Wounds.* The ligatures, one end of which having been cut off close to the knot, are to be brought out opposite to the vessels which they secure. A layer of lint, spread with spermaceti ointment, is to be laid over the plaisters, and the whole secured by a roller carried down from the middle of the thigh.

Is it not sometimes the practice to saw both bones at once, in the same transverse line, and also to saw off the upper angle of the tibia?

1447. The first is frequently done by some of the ablest surgeons, amongst whom is Mr. Guthrie; in which case, the surgeon in operating ought to stand on the inside of the limb to be amputated, in order that he may more readily saw the fibula at the same time with the tibia, which diminishes the chance of splintering the fibula; for the bone is held much more steadily under the saw, when the tibia is undivided, whatever pains may be taken by the assistants to secure it.—*Guthrie on Gun-shot Wounds.*

With regard to the removal of part of the tibia, if the spine of this bone be very sharp, and the patient very thin, it should be removed by the saw.—*Ibid.*

You say that, if necessary, the tibia may be sawn off higher up than the usual point of election, viz., two inches and a half below the tubercle. How high, then, might the tibia be cut through with safety to the patient?

1448. If the nature of the injury admit, that is, if the injury of the tibia do not extend into the joint, this bone may be sawn through as high as the tubercle for the insertion of the ligamentum patellæ, and thus amputation above the knee, at once more severe and hazardous, may be avoided. This practice is authorized by Baron Larrey, Mr. Guthrie, Mr. Hammick, and others, and will be found highly advantageous in military practice, and in emergent cases.

Should the tibia be injured not so high up as to prevent this operation, and yet in such a manner as to lead us to suspect the extension of the fracture into the joint, how would you satisfy yourself on this point?

1449. "An incision should be made on the tibia to ascertain this circumstance, and it need not interfere with the operation, if found to be practicable," which might be performed in the following manner:—The tourniquet having been applied over the artery, as it perforates the triceps femoris, and the position of the patient and assistants being arranged, " the circular incision of the integuments is to be made in the usual manner, and the skin turned back; the muscles on the under part and outside are then to be divided and cleared from the bones, which are to be sawn off, the retractor having been used, to prevent injury to the muscles. The skin over the fibula is now to be separated from it, and the small amputating-knife, on account of its strength, and the ease with which it is managed, applied close to the upper edge of the head of the fibula, where, by a little inclined motion of the hand, it may be easily cut from its articulation with the tibia. The large artery or arteries will be found in the ham, retracted behind the head of the bone, from whence they must be pulled out and cleanly secured, as well as any muscular branches that may bleed."—*Ibid.* The wound is to be closed and bandaged in the manner recommended at 1446.

Under what circumstances will it be desirable to perform the flap operation low down in the leg?

1450. When the surgeon has the choice of selecting his point for the removal of the leg, this mode of amputating is recommended " with a view of preserving a long stump, to which an artificial foot might be attached, and the deformity and inconvenience caused by the operation obviated as much as possible by art."—*Ibid.* The surgeon should therefore be influenced in his decision by the wishes and circumstances of the patient.

In what manner ought the flap operation to be performed?

1451. In the first place the length of the leg must be measured from the highest part of the tibia, to the middle of the inferior protuberance of the fibula, and a mark made upon the leg at the middle part of this line, to shew where the bones are to be sawed. A second mark is to be made an inch lower down on the tibia, as a guide for the transverse semicircular incision of the integuments on the anterior part of the leg; and a third mark should be made on the posterior part of the leg, to show the lowest point of the flap incision.

These measurements having been made, the surgeon is to commence by forming the flap with a small amputating-knife; and in doing this, says Mr. Guthrie, the knife is to cut obliquely inwards and upwards, taking care to have it rather too long than too short. The flap being formed, its angles are to be joined by the semicircular incision, which must be carried across the front of the leg in the line of the mark made for that purpose. The flap is now to be held back, and the deep-seated muscles at the back of the leg divided in the track of the last incision. The interosseous ligament is to be divided by the catlin, interposed between the bones, the muscles protected by a retractor with three straps, and the bones sawed off, as advised in the common operation, the fibula being cut shorter than the tibia, and the spine of the tibia being removed. The vessels are to be secured in the usual way; and Mr. Hey advises, when the crural nerve is found to lie on the inner surface of the flap, that it should be dissected out, and when gently extended, be divided near the extremity of the stump, that it may suffer no compression from the flap. In closing the wound, the straps of plaister should be so applied as not to press too much upon the tibia; the muscles of the calf of the leg should be well bandaged down from above the knee, and the flap always supported until firm union has taken place.—*Guthrie on Gun-shot Wounds, and Hey's Surgery.*

Is not the flap operation sometimes practised when amputation is performed four inches below the patella?

1452. Many excellent surgeons always amputate the leg at the usual place in this manner. Such a practice obtains in St. Bartholomew's hospital. The surgeons of this institution first make the semicircular incision, and afterwards the flap.

ORDER 3.—*Tarso-digitalia.* Emergencies occurring to the ankle and foot.

What bones enter into the formation of the ankle-joint?

1453. The tibia, fibula, and astragalus; the tibia forming the inner, and the fibula the outer ankle.

In what manner is the inferior part of the fibula articulated with the tibia?

1454. The fibula, having been connected with the tibia throughout its whole length by the interosseous ligament, is, lower down, further connected by what is termed the inferior interosseous ligament, passing from the inner side of the external malleolus to the tibia. Its lower end is articulated with the tibia, 1st, by the anterior ligament, passing from the lower part of the fibula to the fore part of the tibia; and 2dly, by the posterior ligament, which passes from the back part of the malleolus externus to the back part of the tibia. This articulation is also strengthened by the tendons of those muscles, that pass over it, especially by those of the peronei and that of the extensor of the toes.

By what ligaments is the ankle-joint connected?

1455. This joint is connected first by a capsular ligament; secondly, by the internal lateral or deltoid ligament, the apex of which is attached to the internal malleolus; "it then passes downwards, becoming broader as it descends, and is inserted into the inner side of the astragalus and os calcis;" 3dly, by an anterior ligament, which passes from the fore part of the tibia to the anterior surface of the astragalus; 4thly, by the perpendicular ligament of the fibula, passing from the inferior extremity of the fibula downwards, to be inserted into the upper part of the os calcis; 5thly, by the anterior ligament of the fibula, passing from the anterior part of the malleolus externus, downwards and inwards, to the fore part of the astragulus; and 6thly, by the posterior ligament of the fibula, passing from the back part of the malleolus externus to the posterior part of the astragalus.—*Vide Bransby Cooper's Treatise on the Ligaments.*

It is further strengthened by tendons: by the tendo achillis, tibialis posticus, long flexors of the toes, and peronei, posteriorly; and by the tibialis anticus, extensor pollicis pedis, and extensor longus digitorum pedis, anteriorly.

What bones constitute the tarsus?

1456. The astragalus, upon which the tibia and fibula rest, the os calcis which supports the astragalus, the cuboides, which is placed anteriorly to the os calcis, the os naviculare, placed before the astragalus, and the three cuneiform bones, which are situated anteriorly to the naviculare. The anterior surfaces of the cuboides and three cuneiform bones are articulated with the metacarpus.

State the ligaments which maintain the astragalus in its articulation with the os calcis.

1457. These bones are held together by an interosseous ligament, connecting them generally; by a posterior ligament, arising from the back part of the astragalus, and passing obliquely inwards to the corresponding part of the os calcis; and by an external ligament, passing from the external face of the astragalus to the outer surface of the os calcis.—*Ibid.*

What ligaments connect the os calcis with the naviculare?

1458. These bones are not articulated, but they are held together by an inferior and an external ligament: the former is remarkably strong, and extends from the smaller tuberosity of the os calcis as far as the inferior surface of the navicular bone, receiving a portion of the astragalus; the latter, very short, stretches from the anterior part of the os calcis to the inferior and outer part of the navicular bone.—*Vide ibid.*

State the ligaments which connect the astragalus with the os naviculare?

1459. These bones are connected by one broad superior ligament, " which covers the whole superior surface of the two bones."—*Ibid.*

By what ligaments is the os calcis connected with the cuboid bone?

1460. By a superior and an inferior ligament; the former stretching from the superior and anterior part of the os calcis to the superior surface of the cuboid bone: the latter, consisting of superficial and deep-seated fibres, is the strongest of the tarsal ligaments. It extends from the posterior and inferior part of the os calcis to the tuberosity on the inferior surface of the cuboid bone, and also to the extremities of the metatarsal bones of the little toe and toe next to it. Both these sets of fibres have the same attachments, and are separated by a layer of fat.—*Vide ibid.*

What ligaments hold the articulation of the os naviculare with the os cuboides?

1461. " These two bones are connected together by two strong ligaments; one being situated on the dorsal region of the foot, and the other on the plantar."—*Ibid.*

By what ligaments are the cuboid bone and the os naviculare connected with the cuneiform bones?

1462. These bones are respectively held by a dorsal and plantar ligament; the former being situated on the back, and the latter on the sole of the foot.

By what bones is the tarsus articulated with the metatarsus?

1463. By the three cuneiform bones, and os cuboides posteriorly, and by the bases of the five metacarpal bones anteriorly; the three first of which are opposed to the cuneiform, and the two last to the cuboid.

State the ligaments which maintain the metatarsal bones in articulation with the tarsus.

1464. These bones are maintained in position by five dorsal ligaments above, and five plantar below, which pass from the three cuneiform bones and the cuboid to the ends of the metatarsal bones, both above and below precisely in the same manner.

By what ligaments are the metatarsal bones connected with each other?

1465. "All the bones of the metatarsus, excepting the first, are in contact with one another at their superior extremities, and present small articular surfaces, which are covered with synovial membrane, and maintained in their respective positions by dorsal and plantar ligaments, of which there are three on each region, passing transversely from one bone to the other, excepting from the first to the second."—*B. Cooper's Treatise on the Ligaments.* They are all also connected by interosseous ligaments.

The anterior extremities of the metatarsal bones are connected by a transverse ligament, precisely in the same manner as the posterior.

GENUS 1.—*Dislocatio.* Dislocation.

SPECIES 1.—*Dislocatio simplex malleolaris.* Simple luxation of the ankle-joint.

VAR. 1.—*Luxatio tibiæ.* Dislocation of the tibia.

In what directions may dislocation of the tibia take place?

1466. The tibia may be dislocated inwards, forwards, and outwards. It is said to be sometimes also dislocated backwards. "The foot has also been known to be thrown upwards between the tibia and fibula, by the giving way of the ligament which unites these bones; but this accident is only an aggravated state of the internal dislocation."—*Sir A. Cooper's Treatise on Dislocations.*

What are the signs of a dislocation of the tibia inwards?

1467. In this case, the internal malleolus is thrown off the astragalus inwards, and stretches the integuments: the foot is thrown outwards, and its inner edge rests upon the ground," whilst, about three inches above the outer ankle, there will be a considerable indentation. To these appearances will be added much tumefaction.—*Iibid.*

What is the cause of the indentation of the fibula a little above the outer ankle?

1468. A fracture of that bone, which usually results from this kind of luxation; and when the fibula is thus fractured, which may be inferred by the depression, and proved by crepitus, the case constitutes what is commonly called "Pott's fracture."

Is this the only bone fractured in severe cases of this kind of accident?

1469. When this injury has been occasioned by a violent cause, such as jumping from a great height, "the lower end of the tibia, where it is joined to the fibula by ligament, is split off, and remains connected with the fibula."

State the best method of reducing this dislocation.

1470. This dislocation ought to be reduced as early as possible. "The patient is to be placed upon a mattress, and is to rest on the side on which the injury has been sustained: the surgeon is then to bend the leg at right angles with the thigh, in order to relax the gastrocnemii muscles; and an assistant, grasping the foot, must gradually draw it in a line with the leg. The surgeon then fixes the thigh, and presses the tibia downwards, thus forcing it upon the articulating surface of the astragalus."—*Sir A. Cooper's Treatise on Dislocations.* Should the surgeon not take the precaution of bending the leg, there will be great difficulty in reducing this displacement.

What is the subsequent treatment of this injury?

1471. The limb, after reduction, is to be placed on its outer side, in the bent position, and encircled with wet compresses and tailed bandage. "Two splints are then to be applied; and each is to have a foot-piece to give support to the foot, prevent its eversion, and preserve it at right angles with the leg.—*Ibid.* If inflammation ensue, it must be met by local and general blood-letting, purgatives, and low diet.

What are the marks of a dislocation of the tibia forwards?

1472. The foot appears shortened, the heel lengthened and firmly fixed, and the toes are pointed downwards. The lower extremity of the tibia forms a hard projection upon the upper part of the middle of the tarsus, under the projected tendons, and a depression is manifest before the tendo achillis. "The fibula is broken, and its fractured end advances with the tibia, and is placed by its side; its malleolus externus remains in its natural situation, but the fibula is broken about three inches above it."—*Ibid.*

Can you explain why the fibula should be broken instead of being dislocated with the tibia in both these injuries?

1473. The lower end of the fibula is not dislocated in either of these accidents, by reason of the very strong ligaments that maintain it in its natural position.

How ought this dislocation to be reduced?

1474. The patient having been placed on his back, and the muscles being relaxed by the bent position, as in the former case, "one assistant grasps the thigh at its upper part, and draws it towards the body, another pulls the foot in a line a little before the axis of the leg, and the surgeon pushes the tibia back to bring it into its place."—*Ibid.*

In what manner ought the joint, when reduced, to be kept in its natural position?

1475. The heel being placed on a pillow, and the foot at right angles with the leg, the joint is to be held in position, first by wet compresses and tailed bandage, and further maintained by the application of two long splints, properly padded, and each having a foot-piece.—*Ibid.* M. Dupuytren recommends one long splint only on the outside, properly bandaged to the foot and leg.

Is not the tibia sometimes partially luxated forwards?

1476. Sometimes partial displacement forwards occurs, in which the tibia rests partly on the astragalus and partly on the naviculare, instead of, as in the complete luxation, upon the naviculare and inner cuneiform bone.

What local symptoms distinguish the partial displacement?

1477. The foot is pointed downwards, and a difficulty is experienced in the attempt to put it flat on the ground; the heel is drawn up, and the foot is in a great degree immoveable."—*Ibid.* The foot is of course not much shortened, nor the heel much lengthened, but the fibula is broken.

Is it not difficult to ascertain the precise nature of this dislocation?

1478. From the absence of much deformity and the presence of considerable tumefaction, this variety of dislocation may be readily overlooked; the surgeon, therefore, ought to be very circumspect in his observations, and attentive in his manipulations, lest he remain ignorant of the real character of the injury, and the patient be rendered lame for life.

In what manner would you reduce this kind of luxation?

1479. In the manner advised for the complete dislocation of the tibia forwards at 1474.

What are the diagnostic marks of a dislocation of the tibia outwards?

1480. "The foot is thrown inwards, and its outer edge rests upon the ground. The malleolus externus projects the integuments of the ankle very much outwards, and forms so decided a prominence that the nature of the injury cannot be mistaken."—*Sir A. Cooper's Treatise on Dislocations.*

In this case, the internal malleolus is obliquely fractured and separated from the shaft; the deltoid ligament is not ruptured, but the capsular ligament is torn through at its outer part. The three fibulo-tarsal ligaments remain whole in most instances, but when the fibula is not broken they are of course ruptured. Sometimes, from the extreme violence that occasions this injury, it is complicated with fracture across, and displacement forwards of the articulating extremity of the tibia, with fracture of the astragalus, and fracture of the fibula into fragments.—*Ibid.*

Describe the mode of reducing this dislocation.

1481. Sir A. Cooper advises the patient to be placed on the back, the thigh to be bent upon the trunk, and the leg at right angles with the thigh. The thigh is then to be grasped under the ham by one assistant, and the foot by another. Thus extension is to be made in the axis of the leg, whilst the surgeon presses the tibia inwards towards the astragalus.

By what means would you retain the bones in position after their reduction?

1482. First, by the application of wet compresses and bandage, and secondly, by placing the limb in the bent position on its outer side, upon a well-padded splint with a foot-piece. A pad is also "to be placed upon the fibula, just above the outer ankle, and extending a few inches upwards, so as in some measure to raise that portion of the leg and support it, and to prevent the slipping of the tibia and fibula from the astragalus, as well as to lessen the pressure of the malleolus externus upon the integuments, where they sustained injury."—*Ibid.*

Another splint of the same kind, but somewhat lighter, should be laid upon the internal part of the leg, and both should be secured in the usual way.

What treatment ought to be adopted in this case to prevent or to combat inflammation?

1483. This case, being generally followed by severe inflammation, will require both local and general bleedings, and the diligent use of cold evaporating lotions, together with a strict antiphlogistic regimen. "The greatest care is necessary to prevent the foot from being twisted inwards, or pointed downwards, as either position prevents the limb from being afterwards useful;" and this prevention is best effected by the splints with foot-pieces above mentioned.—*Ibid.*

Var. 2.—*Dislocatio astragali.* Dislocation of the astragalus.

Under what circumstances is the astragalus generally dislocated, and what are the appearances of this dislocation?

1484. This bone, from its strong ligamentous connexions, is very seldom found dislocated; and when its displacement is effected, it is usually accompanied with fracture of the surrounding bones: this accident occasions much deformity, and the appearances must altogether depend on the direction in which the bone is thrown out of its natural situation.

What is the best method of reducing the dislocation of this bone?

1485. This dislocation is a most serious injury, and is reduced with no small difficulty. If common extension should not succeed, "the use of pulleys will be required, and the action of the muscles should be lessened by tartarized antimony." If the reduction cannot be effected, lameness must result.

Var. 3.—*Dislocatio ossium navicularis et cuboidis.* Dislocation of the navicular and cuboid bones.

What are the appearances of this variety of dislocation?

1486. The five anterior bones are sometimes dislocated at the transverse joint between the astragalus and os calcis, and the naviculare and cuboides. In this case the astragalus and os calcis remain in their normal positions, whilst the fore part of the foot is turned inwards upon the bones. The appearance of this luxation is, according to Sir A. Cooper, that of a club-foot; so much so, indeed, that in one instance, adduced by him, the appearance of the foot was more like a natural defect than an accidental displacement.—*Treatise on Dislocations, &c.*

In what manner ought this luxation to be reduced?

1487. Extension is to be made by fixing the leg and heel, and then the fore part of the foot is to be drawn outwards, by which the reduction will commonly be effected.—*Ibid.*

VAR. 4.—*Dislocatio ossis cuneiformis interni.* Dislocation of the internal cuneiform bone.

In what direction is this bone usually dislocated?

1488. The bone is generally projected inwards, and a little upwards, being drawn up by the action of the tibialis anticus muscle.

Can this displacement be usually reduced, and if not, what treatment would you adopt?

1489. Displacements of the internal cuneiform bone, and probably of the others, rarely admit of being reduced; and in such an event, Sir A. Cooper recommends "first, to confine the bone as much as possible in its natural position, by binding a roller round the foot, and to keep the bandage wet with an evaporating lotion, until the inflammation has subsided, and then to employ a leathern strap, which can be buckled around the foot, so as firmly to confine the bone, until the ligaments are reunited."

Have you any directions to give on the treatment of dislocations of the metatarsal bones from the tarsus, or of the toes from the metatarsus?

1490. The connexion of the metatarsal bones with each other, and their irregular connexion with the tarsus, the second metatarsal bone especially being planted much deeper into the tarsus than the rest, prevent almost the possibility of the dislocation of the metatarsal bones from the tarsus; and the dislocation of the toes from the metatarsus is so rare, as to render it unnecessary to say any thing on the subject in this place. For the treatment of such an accident, as well as of dislocation of the phalanges, the reader is referred to what has been said on dislocation of the fingers.—*Vide* 1135, *and following.*

VAR. 5.—*Dislocatio tendinis peronei longi.* Dislocation of the tendon of the peroneus longus muscle.

Might not the tendon of this muscle be dislocated from the groove in which it runs behind the malleolus externus?

1491. This accident is of very rare occurrence, yet by a sudden and inordinate action of the peroneus longus, its ten-

CASE.—A lady, æt. about thirty-five, whilst walking across a field, felt something suddenly give way with a snap at the outer ankle, which at once rendered her incapable of raising her leg, and caused her to believe that she had don may burst the sheath which confines it behind the malleolus, and dislocate itself upon the lower extremity of the fibula, upon which it may readily be felt lying in a diagonal direction across the bone.

What is the treatment of this accident?

1492. The foot is to be extended, and the tendon pressed back into the groove behind the outer malleolus, where it is to be confined by strips of adhesive plaister, carried around the foot, ankle, and leg, and further secured by compress and bandage, until the ruptured sheath becomes reunited.

SPECIES 2.—*Dislocatio composita.* Compound dislocation.

VAR. 1.—*Dislocatio tibiæ composita.* Compound dislocation of the tibia.

What are the characteristic marks of a compound dislocation of the ankle joint?

1493. These accidents take place in the same direction as the simple dislocations, and the bones and ligaments suffer in the same manner as in those dislocations; the difference, therefore, in these cases is, that the joint is laid open by a wound in the integuments and ligaments opposite to the laceration of the skin, by which the synovia escapes, and through which the ends of the bone protrude.—*Sir A. Cooper's Treatise on Dislocations, &c.* The bone, however, does not always protrude through the skin.

What is the primary treatment of compound dislocations of the ankle-joint?

1494. "The first object will be to suppress hemorrhage, if any of consequence exists. Of the two arteries, the anterior and posterior tibial, which are likely to be wounded, the former will be found most frequently injured, the latter generally escaping; but in case of bleeding from either, it will be

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broken a bone. On my seeing her, she exclaimed, "I have certainly broken my leg." I immediately examined the limb, and perceiving no deformity with regard to the bones, and finding no crepitation by the most accurate exploration, I assured her that she was mistaken. This made no impression on the opinion she had formed; and she again declared that a bone had given way. On examining the limb still more carefully, I felt the round tendon of the peroneus lying across the lower extremity of the fibula, which at once explained the true nature of the accident. The foot being extended, the tendon was readily pressed back into its natural position, which it regained with a snap.

necessary to apply two ligatures, the one above, and another below the aperture from which the bleeding occurs. The projecting extremities of the bones are often covered with dirt, having been thrust against the ground; when the next step will be to cleanse them thoroughly from every particle of extraneous matter, otherwise it will afterwards excite suppurative inflammation in the joint. Should the bone be comminuted or shattered, all detached portions must be carefully removed; and if the wound is not sufficiently large to allow of their being taken out without much difficulty, it should be enlarged with a scalpel, but the incision should be made in such a direction as will avoid further exposure of the joint. The wound will sometimes require dilatation, if the integuments are nipped into the joint by the projecting bone, as they cannot be in many instances liberated without."—*Lectures of Sir A. Cooper, by Tyrrell.*

Describe the mode of reducing compound dislocations of the ankle, and the subsequent local treatment.

1495. "The reduction of the dislocation is to be accomplished by the same means as already described in the simple displacements, *vide* 1470; and when reduced, the edges of the wound are to be very carefully approximated by sutures and strips of adhesive plaister, over which, a piece of lint, dipped in the patient's blood, is to be placed; this, when the blood coagulates, forms, as far as I have seen, the best covering for the wound. The part is to be further supported by the application of separate pieces of linen, in the same way as by the many-tailed bandage, but each portion being unconnected with the others, so that any one piece can be removed, and another substituted for it, by tacking the old and new strips together before the former is drawn from its situation; in this way the limb is not disturbed by the change. This bandage is to be moistened by an evaporating lotion; the padded splints are lastly to be employed with foot-pieces, as recommended in the simple dislocation; but a portion of that one situated on the wounded side of the limb should be cut out, in order to enable the surgeon to dress the wound without removing the splint. The position in which the extremity should be placed is the same as in the simple injury, but must be occasionally varied a little according to the seat and extent of the wound."—*Ibid.*

Are there not cases of compound dislocation of the ankle-joint, in which it might be advisable to saw off the projecting end of the tibia before we attempt to reduce the bones?

1496. "There are some instances in which such a proceeding is absolutely necessary, and many reasons are given for adopting this practice in general."—*Ibid.*

State those cases requiring such treatment.

1497. First, when the dislocation cannot be otherwise reduced without great violence. Secondly, when the extremity of the bone is fractured obliquely, so that if reduced it immediately slips again from its natural position, as soon as the extension is discontinued.

What advantages result from this treatment?

1498. First, by shortening the bones and relaxing the muscles, we shall probably prevent those spasmodic contractions, which are frequently occasioned by the application of great force to replace the bones. Secondly, we shall diminish local irritation, as the curative process will go on more speedily from the sawn extremity of the bone than from the natural articular surface. Thirdly, " When the suppurative inflammation does occur, it is rendered much less, as there is not the same extent, by nearly one half of cartilaginous surface, to be removed by ulceration; and thus, by the diminution of the ulcerative and suppurative process, the constitutional irritation is much lessened."—*Ibid.*

Is not the removal of the end of the tibia attended with hazard to the patient?

1499. Sir A. Cooper does not recollect any case of unfavourable termination from this practice; but, on the contrary, many unfavourable results where it had not been adopted

But would not the certainty of a shortened limb and an anchylosed joint strongly object to the removal of the end of the bone?

1500. If it be admitted that the danger of the case is lessened, such objections ought not to weigh with us: besides, a shortened limb can be in great measure remedied by a deep sole to the shoe; and an anchylosed joint is as likely to take place in the one mode of treatment as in the other; and where anchylosis does take place, the obliteration of the joint is in some measure compensated by an increase of motion of the tarsal bones.—*Vide ibid.*

Will not amputation below the knee be preferable to either mode of treatment?

1501. It was once the practice of the surgeons of this country to perform amputation in compound dislocation of the ankle-joint, as the best means of preserving the life of the patient; but the experience of modern surgery deems such extreme practice unjustifiable in the majority of such accidents.

Were you called to a case of compound dislocation of the ankle-joint, either on the outer or inner side, in which the bones were shattered, or fractured obliquely, so that the reduction could not be maintained, what would be your treatment?

1502. This state of things would not justify amputation in either point of view. I would in the first place remove the separate pieces of bone, and then smooth the ends of the shafts, that they may rest firmly upon the astragalus.

Might it not be sometimes necessary to remove the lower extremity of the fibula, though remaining in its normal position, in such a case as you have just related?

1503. Were this to be found loose, and an impediment in the way of reduction, it ought to be removed. Sir A. Cooper removed the outer ankle in a case of compound dislocation, mentioned in his lectures, and the case terminated successfully: he removed it by dividing the ligaments with a scalpel.

You state that in the majority of cases of compound dislocation of the ankle-joint, amputation is not justifiable; what are the exceptions, that require immediate removal of the limb?

1504. First, advanced age, " when the powers of the constitution are not sufficient to support the extensive suppurative inflammation likely to follow the injury, but which the operation of amputation does not expose the patient to."

Secondly, " a very extensive lacerated wound, with much hemorrhage."

Thirdly, the association of extensive comminution of the tibia or tarsal bones, especially of the astragalus and os calcis.

Fourthly, the division of the posterior tibial artery and nerve, along with extensive wound.

Fifthly, " extensive contusion of the surrounding soft parts, likely to occasion the formation of large sloughs," especially if it have been occasioned by the passing of the wheels of a heavy-laden carriage over the joint, or by the falling of a very heavy weight upon the limb."—*Vide Sir A. Cooper's Lectures, by Tyrrell.*

Do you consider the internal or external compound dislocation of the tibia the most dangerous to the patient?

1505. The external dislocation, being generally accompanied with extensive injury to the soft parts as well as to the bones, will be the most hazardous, and will indeed often require amputation.—*Vide ibid.*

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Var. 2.—*Dislocatio astragali composita, et ossium tarsi.* Compound dislocation of the astragalus, and of the tarsal bones.

What would be your treatment of a compound dislocation of the astragalus?

1506. The treatment of this injury must depend on the circumstances of the case. If possible, the displaced bone ought to be brought back to its proper position by extension of the foot, whilst the knee is fixed and the leg bent upon the thigh, and the reduction treated as was advised for the treatment of compound dislocation of the ankle-joint, at 1495; but if the reduction cannot be effected, it will be best to remove the whole or part of the bone, as might seem most desirable, as this has been frequently done, and the patient has recovered a useful limb.

Should a compound displacement of the astragalus be accompanied by a rupture of the posterior tibial artery and laceration of the tibial nerve, what would be your practice?

1507. I would not amputate in such a case; but remove the astragalus and secure the artery. This practice was adopted by Mr. Professor Green, and his patient recovered.

What treatment is required in compound displacements of any other of the tarsal bones?

1508. The treatment must be conducted upon general principles. We ought always to endeavour to replace the displaced bone; and close the wound in the usual manner (*vide* 1495); but if it be impracticable to effect this, the projecting bone should be removed, or otherwise treated, as circumstances shall require.

What are the constitutional symptoms, which usually follow compound dislocation of the ankle-joint, or severe compound dislocation of the bones of the tarsus, when we attempt to preserve the limb?

1509. "About twenty-four hours, or in two or three days, after the receipt of the injury, the patient begins to complain of pain in the head and neck, showing the influence of the accident upon the brain and spinal marrow. Loss of appetite, nausea, and often vomiting, indicate disorder of the stomach; the tongue is white, yellowish, or brown, according to the degree of irritation; the bowels generally become inactive, from a paucity of the secretions, not only from their mucous surface, but from the glands connected with them, as the liver, pancreas, &c. The secretion from the kidneys is much diminished, and of a deep colour; the skin becomes hot and dry, ceasing to pour out the perspirable matter. The action of the heart and arteries is accelerated, the pulse becoming hard, and in severe cases it is often irregular and intermittent. The respiration is hurried in sympathy with the quickened circulation. When the irritation is great, the nervous system becomes further affected, the patient is restless and watchful, and as the severity of the case increases, delirium, and subsultus tendinum, occur.—*Sir A. Cooper's Lectures, by Tyrrell.* As these symptoms proceed from the joint being opened, the importance of immediately closing the wound is sufficiently manifest.

What measures would you adopt to subdue the constitutional symptoms consequent upon these injuries?

1510. In some cases general bleeding will be necessary, but it should never be carried to such an extent as to produce debility, lest the constitution be crippled and rendered unequal to sustain the profuse discharge about to follow. Purgatives will be also necessary; and these also should be used with caution, lest the wound be disturbed and disunited. The bowels should be emptied immediately after the local treatment has been disposed of, and "before the adhesive inflammation is set up; subsequently to this, mild aperients may be given occasionally."

VAR. 3.—*Dislocatio metatarsi ossium and phalangum composita.* Compound dislocation of the metatarsal bones and toes.

What would be your treatment of these accidents?

1511. The treatment of compound dislocations of the metatarsus and toes is the same as that recommended for similar injuries of the metacarpus and fingers.—*Vide* 1133 and following.

GENUS 2.—*Fractura.* Fracture.

SPECIES 1.—*Fractura simplex.* Simple fracture.

VAR. 1.—*Fractura articulationis malleolaris.* Fracture of the ankle-joint.

In what direction is the tibia usually fractured into the joint?

1512. "The tibia is often broken into the ankle-joint, or through the bone a little above it; and these fractures pass either obliquely inwards or obliquely outwards: the first is in a line from one or two inches above the external malleolus to the inner ankle; the second from one to two inches of the tibia above the ankle, downwards and outwards into the joint."—*Sir A. Cooper's Treatise on Dislocations, &c.*

In what way would you discover this injury?

1513. Simple fracture of the tibia into the joint is to be discovered "by crepitus at the ankle when the foot is rotated, bent, or extended, and by a slight inclination of the foot outwards." If the fracture be situated just above the joint, it may be discovered by the lower end of the tibia slightly projecting over the inner malleolus. If the joint be obliquely fractured downwards and outwards, "the foot is slightly inclined inwards, and the malleolus externus projects more than it naturally would."

What treatment would you adopt in simple fracture of the ankle-joint?

1514. I should employ the tailed bandage, with evaporating lotions. Splints should then be applied, "with a foot-piece to each, padded, so as to incline the foot inwards, and to bring the toe into its natural line with the patella." "The leg should be raised so as to bend and elevate the knee, and the limb should rest upon the gastrocnemius muscle and upon the heel. The splints will support the foot on each side, and the leg should be supported by a pillow reaching from the knee to beyond the foot, secured by tapes around it."—*Ibid.*

What other fracture of the joint sometimes occurs?

1515. The outer portion of the lower end of the tibia is sometimes split off by jumping or falling from a great height; the result of this is, that the tibia is dislocated inwards, and the foot is forced up between the bones of the leg.

State the treatment that such a case requires.

1516. The foot is to be brought back again into its natural position, and the case treated as a dislocation inwards.—*Vide* 1470.

VAR. 2.—*Fractura ossium tarsi, metatarsi, and phalangum.* Simple fracture of the tarsal and metatarsal bones, and of the toes.

Have you any directions to give in the treatment of simple fracture of the tarsal bones?

1517. Simple fracture of the tarsal bones is an extremely rare occurrence; and when such an injury takes place, no splint will be required, as the fractured bones will have ample support from each other. The only treatment necessary will be to lay the limb in the straight position on a pillow, which should be made to support the leg and foot by tapes drawn round it transversely. Inflammation should be prevented and combated by cold evaporating lotions, and leeches, with spare diet.

What treatment will be required in simple fractures of the metatarsal bones and toes?

1518. The same, for the most part, as was recommended in similar injuries of the metacarpus and fingers. *Vide* 1159.

Species 2.—*Fractura composita.* Compound fracture.

Var. 1.—*Fractura articulationis malleolaris composita.* Compound fracture of the ankle-joint.

What is commonly the result of oblique compound fractures into the ankle-joint, and what treatment do they require?

1519. According to the opinion of Sir A. Cooper, "oblique compound fractures into the ankle-joint generally do well, if care be taken to produce adhesion of the wound, which is to be effected by applying lint, imbrued in blood, to the lacerated skin, and by leaving it there till it separates spontaneously. The same bandages and splints are required as in simple fractures (vide 1514), but the position must be varied according to the situation of the wound."

Although an injury to this extent may commonly end well, are there not compound fractures of the ankle-joint, which, from their character, would not justify any attempt to preserve the limb?

1520. Yes; even the above case, in very advanced age, would require immediate amputation; and if, with a compound fracture into the joint, there be much comminution of bone, and hæmorrhagy from any large vessel, it will be proper to amputate immediately, more especially if the patient be obliged to obtain his bread by his labour; for after recovery, under great comminution, the limb will bear but slight exertion." —*Sir A. Cooper's Treatise on Dislocations, &c.*

Should compound fracture of the ankle-joint be occasioned by gun-shot, what would be your practice?

1521. The treatment will depend on the extent of the fracture. If the tibia, or if the astragalus, be in part fractured, cold applications and the strictest antiphlogistic regimen should be enforced, "and amputation only resorted to when it can no longer be avoided."—*Guthrie on Gun-shot Wounds.* "But if a musket-ball or grape-shot passes fairly through the ankle-joint, and the tibia and astragalus be both fractured in the track of the ball, it will be best to amputate the limb. Again, "If the shot should have passed laterally through the joint, with destruction of the lower head of the fibula, thereby including the three bones, amputation is necessary without delay."—*Ibid.*

VAR. 2.—*Fractura tarsi et metatarsi ossium, et phalangum composita.* Compound fracture of the tarsus, metatarsus, and toes.

Do you not consider compound fractures of the bones of the tarsus more dangerous to the patient than, cæteris paribus, compound fractures of the carpus?

1522. They are certainly so considered, and such an opinion is borne out by the result of experience, as injuries of the tarsus, and indeed of the foot generally, are followed by more defective cures than similar injuries of the hand.

What are the more common causes of compound fractures of the foot?

1523. Musket-balls in military, and the pressure of carriage wheels and the falling of heavy weights in civil, practice.

Do not such injuries require the immediate and particular attention of the surgeon?

1524. "The treatment of these wounds," says Mr. Guthrie, "requires greater attention and more aid from surgery, than is necessary in other parts; for a musket-ball will seldom pass through the foot without injuring a joint of some kind, or wounding a tendon or nerve; and the injury to the fascia, which is very strong on the sole of the foot, and frequently covered by much thickened integument, is always attended with inconvenience. The extraction of balls, of splinters of bone, of pieces of cloth, and the discharge of matter, become more difficult, and often cause so much disease as to render amputation of the foot ultimately necessary." Tetanus is also the frequent consequence of such injuries. For the above reasons, we should be most careful to examine every wound of the foot with the greatest attention, that the entrance of musket-balls, or of any extraneous matter, might be detected, and that whatever operative treatment might be deemed requisite, be done as soon as possible after the injury.

Are not wounds of the foot from musket-balls very deceptive?

1525. They are sometimes so; "for although the opening be apparently too small to permit a ball to pass in, still I have several times seen one found at a later period, and the most serious consequences ensue from its not having been discovered sooner."—*Guthrie on Gun-shot Wounds.*

What would be your practice, if a cannon-shot were to strike and tear away a part of the os calcis?

1526. Should the ankle-joint be untouched, Mr. Guthrie does not sanction amputation, but advises that all spiculæ of bone be removed, and early and free openings made for the discharge of matter. Such a case then should be laid in a large poultice, or enveloped in compresses wet with cold water, and if due attention be paid to the above directions, the limb will probably be preserved to be of considerable use.

What treatment is required where a musket-ball has passed through the tarsus?

1527. "To be able to judge if amputation be requisite, or indeed in the treatment of any severe wound of this kind, it will almost always be necessary to enlarge the original wound, which, from the position of the soldier, may be said to be on the upper part or side of the foot. The splinters of bone are to be removed, if possible; the ball (if lodged) and extraneous substances are to be taken out; and if the bones, tendons, and blood-vessels, are so much injured as to render the attempt to preserve them useless, amputation is to be performed; but if the preservation of the limb be thought practicable, and it generally will be so in wounds from musket-balls, the attempt must be made under the most rigid antiphlogistic treatment, the local application of cold water from the first, and with free openings for the subsequent discharge."—*Ibid.*

What primary treatment would be requisite, where a musket-ball has struck and injured the metatarsal bones?

1528. "Musket-balls seldom injure the metatarsal bones so much as to require their removal with their toes Under the treatment above mentioned (1527), these wounds will in general be healed without further operation. Wounds from grape-shot occasionally render the removal of the metatarsal bone of the great toe at the tarsus necessary, although much should be done to save it. The little and adjacent toes are also sometimes removed at the tarsus; the middle ones but seldom, as it is not an easy operation to perform, in consequence of the natural close attachment of these bones, and the additional compactness they have required from the pressure of the shoe. I have never performed this last operation, and I think the removal of the pieces of bone, with free openings for the discharge, will in general supersede the necessity of doing it in these cases."—*Ibid.*

Would not the age of the patient very much influence your decision in the treatment of compound fractures of the tarsus or metatarsus?

1529. The age of the patient ought always to have weight in our deliberations; for whilst in a young man a wound of this kind might not require the primary operation, the same injury in an old person might demand immediate amputation.

Should there be, along with compound fracture of the foot, hemorrhage from the arteries, what would be your practice?

1530. Hemorrhage in such case does not authorize amputation; "for the incisions necessary to secure the bleeding vessels will not in general add much to the original injury, except they are very extensive indeed; on the contrary, they will render the wound less complicated."—*Guthrie on Gunshot Wounds.*

Do you consider acute tetanus a proper object for amputation of the foot?

1531. Amputation has not been found effectual in removing the symptoms of acute tetanus, and therefore ought not to be performed in such a case.

What, then, are the compound fractures of the foot that require primary amputation?

1532. Cases of compound fracture of the foot requiring immediate amputation are, 1st. When the foot has been torn off by a cannon-shot, or the explosion of shells; 2dly. When the bones have been comminuted by the crush of a wheel, the fall of ponderous bodies, or the violence of machinery.

At what point of the limb ought the operation to be performed?

1533. The operation might take place below the knee, at the tarsus or metatarsus, according to the situation of the injury, "recollecting that it is of greater importance to preserve the great toe than any other."

Describe the method of amputating the foot at the junction of the tarsus with the metatarsus?

1534. "The joints of the metatarsus with the tarsus being well ascertained, an incision is to be made across the foot in the direction of the joints, but nearer the toes, and the integument retracted back over the tarsus. From the out and inside of the end of this incision, two others are to be made along the sides of the great and little toe for about two inches and a half, according to the thickness of the foot; and the ends of these two incisions are to be united by a transverse one down to the bone on the sole of the foot, by which the corners may be rounded off. The flap thus formed on the under part is to be dissected back from the metatarsal bones, including as much muscular flesh as possible, as far as the under part of the joints of the tarsus. The metatarsal bones are now to be removed by cutting into and dislocating each from the side, which facilitates the performance of it. The arteries are now to be secured; any long tendons and loose capsular ligaments are to be removed with the knife or scissars, and the under flap, formed from the sole of the foot, is to be raised up so as to make a neat stump, when brought in contact with the upper portion of integuments that were first turned back; the whole to be retained in this position by sutures, adhesive plaister, and bandage."—*Ibid.*

But if the situation of the injury required it, might not the foot be amputated with equal facility nearer the ankle-joint?

1535. Were it necessary from such a cause, the amputation of the foot may be performed at the junction of the calcaneum and the astragalus, with the cuboid and navicular bones, according to the practice of Monsieur Chopart.

Describe the method of performing this operation.

1536. "The tourniquet having been applied, the surgeon is to make a transverse incision through the skin which covers the instep, two inches from the ankle-joint. He is to divide the skin and the extensor tendons and muscles in that situation, so as to expose the convexity of the tarsus. He is next to make on each side a small longitudinal incision, which is to begin below and a little in front of the malleolus, and is to end at one of the extremities of the first incision. After having formed, in this way, a flap of integuments, he is to let it be drawn upwards by the assistant, who holds the leg. There is no occasion to dissect and reflect the flap, for the cellular substance, connecting the skin with the subjacent aponeurosis, is so loose, that it can easily be drawn up above the place where the joint of the calcaneum with the cuboides, and that between the astragalus and scaphoides, ought to be opened. The surgeon will penetrate the last the most easily, particularly by taking for his guidance the eminence which indicates the attachment of the tibialis anticus muscle to the inside of the os naviculare. The joint of the os cuboides and os calcis lies pretty nearly in the same transverse line, but rather obliquely forward. The ligaments having been cut, the foot falls back. The bistoury, or scalpel, is then to be put down, and the straight knife used, with which a flap of the soft parts is to be formed, under the tarsus and metatarsus, long enough to admit of being applied to the naked bones so as entirely to cover them. It is to be maintained in this position with three or four strips of adhesive plaister, which are to extend from the heel over the flap to the inferior and anterior part of the leg."—*Cooper's Dictionary of Practical Surgery.*

What arteries will require ligature in this operation?

1537. The anterior tibial on the instep, and the internal and external plantar arteries in the sole of the foot forming the flap.

Will not the position of the wound frequently interfere with the above method of forming the flap?

1538. The position of the wound will often prevent the surgeon from following prescribed rules, when he will have to act on his own judgment, and form the flap from the upper part of the foot, or in any other manner that may be indicated by the peculiar circumstances of the case.

Should the foot require to be amputated, from compound fracture of the distal ends of the metatarsal bones, might not the operation be performed through the bodies or shafts of the metacarpal bones?

1539. This may be and has been done, but by this method the stump will be much less defended than when the division is made at the joints of the metatarsus with the tarsus.

In what manner would you amputate either the external or internal metatarsal bone?

1540. This will best be done "by an incision round the root of the toe, terminating in a line on the outside of the foot, which is continued down to the joint of the tarsus. The integuments are turned back above and below from the metatarsal bone, which is to be dissected out with the toe attached to it, and the flaps brought together, so as to leave but one line of incision."

This method of Sir C. Bell is acknowledged to be the best, and which, in a diseased joint, can generally be adopted; but what would be your practice in a case of emergency, where perhaps the bone may be comminuted, and the soft parts extensivly lacerated?

1541. Under such circumstances, in removing the metacarpal bone I should so direct my incision as to preserve such part or parts of the integuments as had suffered the least injury, in order that the wound may be covered in the best possible manner.

Describe the method of amputating the phalanges of the toes.

1542. These operations are to be performed in the manner recommended for the removal of the fingers.—*Vide* 1193 *and following.*

Genus 3.—*Vulnus proprium pedi.* Wounds connected with the foot.

By what arteries is the foot supplied?

1543. By the anterior and posterior tibial, the latter of which is divided into the internal and external plantar arteries.

State the course of each of these arteries.

1544. "The dorsalis pedis, which is a continuation of the anterior tibial artery, may be marked out by a line drawn from the inner border of the head of the fibula to the middle of the bend of the ankle, and thence continued onwards to the first metatarsal space."—*Quain's Elements of Anatomy.* The posterior tibial artery, having passed between the malleolus internus and tendo-achillis, with the tibialis posticus, and flexor longus digitorum pedis, on its inner, and the flexor longus pollicis pedis and posterior tibial nerve, on its outer side, runs in the hollow of the os calcis and behind the abductor pollicis to the sole of the foot; and as it is about to go behind this muscle, it divides into the internal and external plantar arteries. These run under the aponeurosis plantaris, the flexors of the toes lying between them. The plantaris interna runs on the inner side of the sole, between the abductor pollicis and fascia plantaris, to the root of the great toe, where it sends a principal branch to its inner side, and then passing under the flexor longus pollicis, anastamoses with the arcus plantaris, and having bifurcated, gives one branch to the outer side of the great toe, and the other to the inner side of the toe next.

The external plantar, the larger of the two, "passes obliquely outwards, between the flexor brevis digitorum pedis and flexor accessorius, till it reaches the base of the metatarsal bone of the little toe. It is now arched forwards between the flexors and metatarsal bones of the small toes, the trunk being continued to the root of the great toe, under the name of the arcus plantaris."

"The arcus plantaris sends off branches to the interosseal muscles; one branch to the outer side of the little toe, and three large digital arteries, which are forked at the roots of the toes, and run along the edges of these in the manner of the digital arteries of the fingers."

Is there not a free communication between the arcus plantaris *of the posterior tibial and the dorsalis pedis of the anterior tibial artery?*

1545. A very free communication takes place between these arteries, by means of a branch called the ramus communicans, which runs betwixt the metatarsal bones of the great toe and toe next.

Is not the tendo-achillis sometimes wholly or partially lacerated?

1546. Yes; this tendon is sometimes lacerated by an unexpected and inordinate action of the gastrocnemii muscles, when the patient feels the sudden sensation of rupture in the situation of the tendon, and immediately becomes incapable of walking.

What would be your treatment of this accident?

1547. The limb having been laid on its outside upon pillows, the knee is to be kept bent and the foot extended, in order to allow the ends of the ruptured tendon to come in contact. In this position the limb must remain till the tendon is re-united. Bandages and evaporating lotions will of course be necessary.

Should the tendon be divided by a scythe or sabre-cut, what treatment would be required?

1548. In such a case it is probable that the posterior tibial artery will be wounded. If so, the vessel must first be secured. The lips of the wound are then to be brought together by strips of adhesive plaister, and, if necessary, by suture, and the case afterwards treated in the same manner as was recommended for the spontaneous rupture of the tendon.

Should the anterior tibial artery be opened by an incised wound on the upper part of the foot, in what manner would you take up the artery?

1549. In tying this artery, we must not forget to tie both ends of the vessel, otherwise there will still be bleeding from the inferior end, supplied by the ramus communicans, coming up between the two first metatarsal bones, as above mentioned.

In a wound of the plantar arteries, what would be your treatment?

1550. We ought in the first place to endeavour to suppress the hemorrhage by wet graduated compresses and a roller, at the same time moderating the flow of blood into the arteries by the action of the tourniquet: if, however, this method should fail, the wound should be dilated freely, and the artery secured; and lastly, should such a practice be deemed unjustifiable, from the position of the wound, the posterior tibial artery must be secured, as it passes behind the malleolus internus, where it will be found about a quarter of an inch posteriorly to the malleolus, and a little anteriorly to the situation of the posterior tibial nerve.

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ERRATA.

Page 5, line 1, for *axillæ*, read *axilla*.
... 54 ... 12, for *cuneiforme*, read *unciforme*.
... 100 ... 22, for *species*, read *var*.
... 105 ... 7, for *species*, read *genus*.
... 131 ... 36, for *species*, read *genus*.
... 153 ... 23, for *and*, read *et*.
... 160 ... 17, for *metacarpal*, read *metatarsal*; and again in line 36.

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